12057
194

Western Engineering

VOL. 3 SAN FRANCISCO, JULY, 1913 NO. 1

PUBLISHED MONTHLY BY THE WESTERN ENGINEERING PUBLISHING CO. AT 420 MARKET STREET, SAN FRANCISCO.

Entered as second-class matter, June 1, 1912, at the post-office at San Francisco, California, under Act of March 3, 1879

Telephone Kearny 4777. Cable Address: Pertusola. Code: Bedford McNeill (2 editions).

BRANCH OFFICES:

CHICAGO—734 Monadnock Building. NEW YORK—Woolworth Building.
LONDON—The Mining Magazine, 819 Salisbury House, E.C.

ANNUAL SUBSCRIPTION:

United States and Possessions, and Mexico..... $3
Other Countries in Postal Union 4

CHARLES T. HUTCHINSON, Editor L. A. GREENE, Business Manager H. L. QUIGLEY, Advertising Manager

TABLE OF CONTENTS

EDITORIAL: Page.
- Notes 3
- How Is Business? 4
- The Minnesota Rate Case 5

REVIEW OF THE MONTH 7

ARTICLES:
- San Francisco Wharf and Dock Construction.....*Jerome Newman* 11
- Numbering Systems .....*Raoul Bricard* 18
- Shipping and Sampling Crude Oil.....*Paul M. Paine* 22
- City Waterway Bridge, Tacoma.....*John Lyle Harrington* 28
- California State Roads.....*S. J. Van Ornum* 31
- Reinforced Concrete Oil Tank.....*Edward L. Mayberry* 37
- Petroleum Products in Europe.....*Robert P. Skinner* 39

THE ENGINEERING DIGEST:
- Earnings and Investment in Transit Facilities.....*Bion J. Arnold* 40
- Denatured Alcohol as a Decarbonizer and Engine Cleanser..*Joseph A. Anglada* 42
- The Manufacture of Petroleum Products.....*F. C. Robinson* 47
- Klamath River Hydro-Electric Development.....*J. C. Boyle* 52
- High Flume Trestle in Idaho.....*A. M. Korsmo* 55
- Electrolysis from Stray Electric Currents.....*Albert F. Ganz* 57
- Cost of Hauling With Tractor Outfits on Illinois Road Construction..... 58

COMPANY REPORTS 59

BOOK REVIEWS 60

HINTS ON PRACTICE:
- Care of Air-Compressors 61

ENGINEERS' NOTE BOOK:
- Water-Pressure on Cylindrical Surfaces 62

INDUSTRIAL PROGRESS:
- Ozone and Its Applications 64
- Safeguarding the Induction Motor 68
- A New Method for Taking Levels 72
- Hauck Portable Burners 72

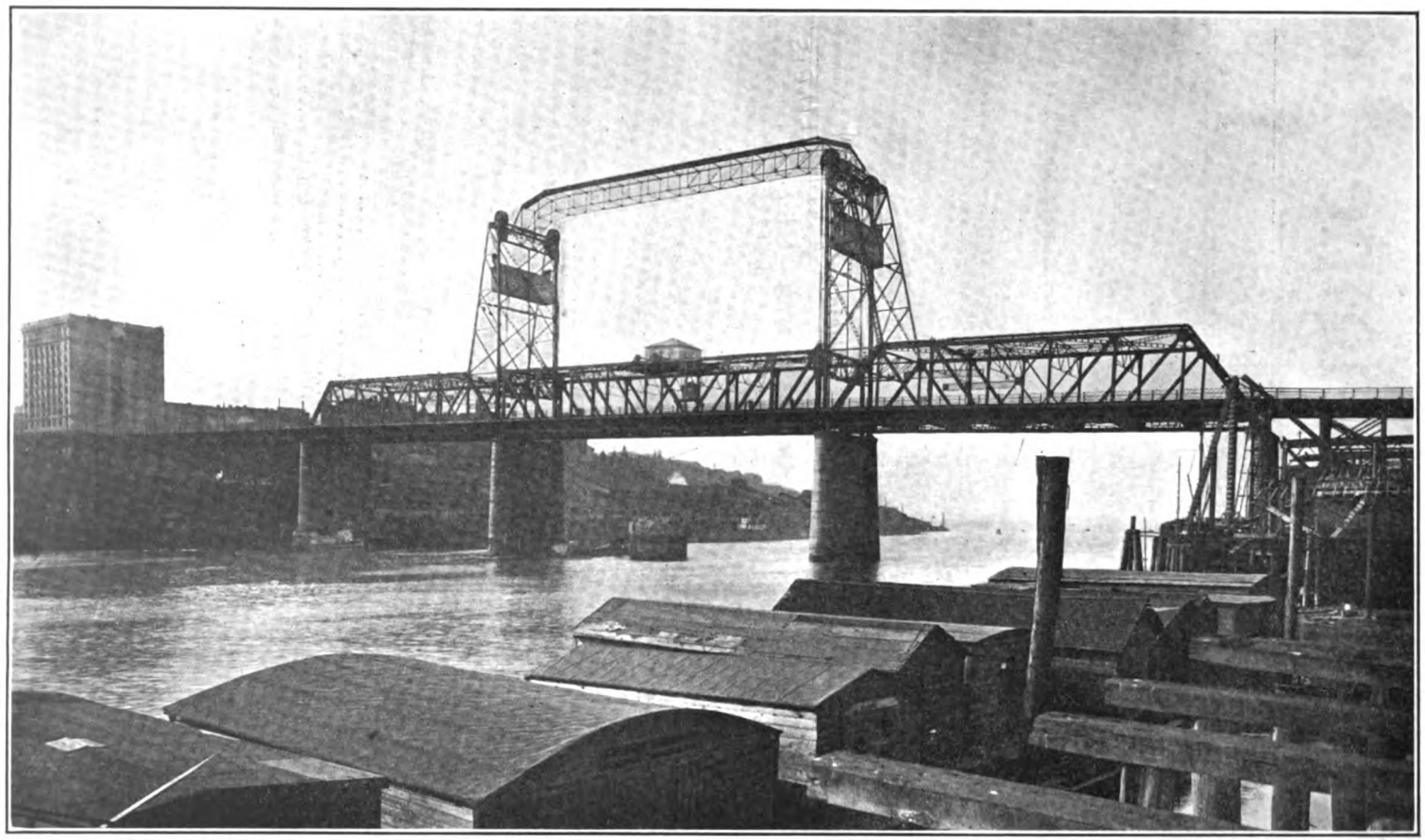
ENGINEERING NEWS 73

PERSONALS, COMMERCIAL PARAGRAPHS 82

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google



THE CITY WATERWAY BRIDGE AT TACOMA, WASHINGTON.

(See Page 28.)

Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

EDITORIAL

'ARRESTED for speeding.' Motorists appreciate the significance of those words to their sorrow. The port warden at San Pedro harbor is out for bigger game than automobiles, however. There is an ordinance in effect providing for a speed limit of four miles per hour for vessels plying within the inner harbor. The infraction of this law has led to the arrest of the masters of the steamers *Harvard* and *Catalina*, and it is said that more arrests are to follow. The fact that the port warden's name is Fugit lends an air of verisimilitude to the tale and conveys a warning to other transgressors.

BY means of an amendment to the bond act made by the last session of the California state legislature, the people of Los Angeles will have an opportunity to vote again on the issue of municipal power-bonds that was defeated in the election of April 15. It would appear that the construction of another city distribution system would provide a needless duplication of work, unless it can be shown that the present privately-owned service is inadequate or exorbitant in cost. The advocates of municipal ownership and operation, in this case at least, appear to have more influence with the legislature than with the voters.

CORRESPONDENCE instruction has been taken up by the University of California. While full details as to the branches of study to be pursued have not yet been fully decided upon, it is understood that courses in the various economic and scientific fields will be available for both men and women. Those interested should communicate with the University and express their desire as to the field of study into which they desire to enter. The comparative demand will determine the courses to be adopted for the first year's work.

IT IS to be regretted that the Governor of California has exercised the 'pocket veto' in the case of the Sutherland oil-land protection bill. This measure was prepared after a long series of conferences of representative oil men, and was devised as a means of protecting the industry from injury due to unscientific production methods. As the situation stands at present, any driller may, without restraint, permit water to flow into the oil-sand and thus ruin his neighbor's well. It is to be hoped that the men who are taking a constructive interest in the welfare of the industry will not abandon their efforts to obtain corrective measures, but will continue the fight and bring the matter up again at the next session of the Legislature.

ANOTHER practical example of the advantages of coöperative effort is shown by the announcement that work on the Tumalo irrigation project in Oregon is about to be resumed. After the project failed by private enterprise, Mr. John H. Lewis, State Engineer of Oregon, succeeded in enlisting the coöperation of the United States Government, with the result that Oregon has appropriated $450,000 and Secretary Lane will recommend that a like amount be taken from the Rec-

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

lamation fund, if the engineers find it feasible and free from legal obstacles. Work will be undertaken as soon as possible, and 35,000 acres of arid land will be converted into productive soil. State engineers will do well to read Mr. Lewis' discussion on the subject of 'Coöperation between State and Nation in Irrigation and Power Development,' published in *Western Engineering* of April last. We know of no reason why this principle should not be equally applicable in other states.

How is Business?

This is a difficult question to answer, especially at the present time. The New Yorker who deals in money as a commodity, the promoter who makes a living through the flotation of new enterprises, and the broker whose livelihood depends upon the human propensity to gamble on the stock exchange, form a trio of glooms, unable to extract a ray of sunshine from the situation. The decision of the court in the Minnesota rate case is the drop that filled their cup of unhappiness to overflowing. In fact, a 'near' panic was only averted by the announcement of the Secretary of the Treasury that he would issue $500,000,000 in emergency currency if necessary. On the other hand, manufacturers of standard goods are busy night and day trying to fill their orders. Most of them are too busy even to complain of the tariff revision. How long this can continue while our uncles in Wall Street keep the purse-strings tight, is a matter of conjecture. That corporations from now on will be subject to regulation is an established fact. We do not pretend to say that the Minnesota rate case marks the end of any further resistance on the part of the railroads, but it appears to settle definitely the legal right of the states to regulate intrastate rates, at the same time that it points the way for Congress to assume complete charge of the matter. Now that the curb has been applied with vigor and emphasis, caution should be exercised, lest our iron horse become not only broken, but broke. Good bonds covering the improvement of existing utilities and new development enterprises go begging on the market. Even municipal and state issues are suffering with the rest. Here in the West, where we are rich in natural resources and short of money, many development enterprises are having difficulty in marketing their securities. It is true that during this season of the year large withdrawals of funds are made by country from the city banks for moving the products of the farms. The bulk of these funds ultimately finds its way into railroad and other transportation company's coffers, and as this year crops have been unusually bountiful, a goodly share of the nation's money supply will find its way back into circulation. However, there is no denying the fact that money is tight. The tariff question has everybody guessing, and until the bill has passed its final reading and been approved by the President, no one will make a move. Then will come a time of readjustment to meet the new trade conditions. Prices of the various commodities affected will necessarily go down, but what will be the effect on labor conditions? The public utilities, common carriers, and manufacturers are face to face with increasing exactions from the labor unions on the one hand and governmental regulations and restrictions on the other. This, coupled with the increasing tendency toward municipal ownership of public utilities, adds to the feeling of

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

uncertainty among investors. It would appear that the right of the Government to regulate, carries with it an obligation to protect. Protection should mean the safeguarding of capital, not only against indiscriminate price competition, but unjustified demands from labor unions as well. Working both ends against the centre is like Aesop's fable of the small boys who amused themselves by throwing stones at the frogs. It was fun for the boys, but was death to the frogs. Further demands for increased wages on the part of the labor unions must sooner or later become a matter for the Government to adjudicate. This will place upon the regulating body the duty of determining just what portion of the profit accruing from the transaction of the world's business belongs of right to capital and what part belongs to labor. In the meantime, the goose that lays the golden eggs, while not sick unto death, is certainly doing poorly. It is not to be forgotten, moreover, that the United States is not alone in trouble. Money is as 'tight' in Berlin as in New York, and only a general readjustment seems likely to afford real relief.

The Minnesota Rate Case

While the decision of the Supreme Court of the United States in what is known as the Minnesota rate case is primarily concerned with passenger and commodity rates, an interpretation of the law governing the regulation of interstate and intrastate commerce is also involved that establishes a precedent of far-reaching import to all common carriers. In 1907 the state of Minnesota passed a law reducing passenger rates to 2 cents per mile and commodity freight rates 7.37 per cent. Alleging in effect that these rates were confiscatory and interfered with interstate commerce, thereby being unconstitutional, and null and void, legal proceedings were instituted by the railroads involved. The case was tried before the United States Circuit Court for the Minnesota district. After taking testimony for a period of 2½ years, judgment was rendered in favor of the railroads in every particular. Appeal was then made by the Minnesota authorities to the United States Supreme Court. The issues were clearly defined as affecting the power of the state to regulate rates within its own lines for common carriers engaged in interstate commerce. The question was also before the Court as to whether the rates established by the Minnesota authorities were confiscatory. The decision as rendered is partly in favor of the railroads and partly in favor of the state, the memorandum handed down by the Court being as follows:

"These appeals involve the validity of orders of the Railroad and Warehouse Commission and the legislative acts of the state of Minnesota, prescribing maximum rates for freight and a maximum fare of 2 cents a mile for passengers. The rates relate to traffic exclusively between points in the state. It was contended, however, that as applied to cities on the state's boundary or to places within competitive districts crossed by the state line, the rates disturb the relation previously existing between interstate and intrastate rates, thus imposing a direct burden upon interstate commerce, creating discriminations as against localities in other states. The rates were also assailed as confiscatory. The rates are sustained as to the Northern Pacific and the Great Northern companies. In the case of the Minneapolis & St. Louis Railroad Co., the rates are held to be confiscatory. Minnesota did not transcend the

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

limits of its authority in prescribing the rates involved, assuming them to be the reasonable intrastate rates. It exercised all authority appropriate to its territorial jurisdiction, and this was not opposed to any action thus far taken by Congress."

In reviewing the question involved, the Court holds:

"The inter-blending of operations in the conduct of interstate and local business by interstate carriers, and the exigencies that are said to arise with respect to maintenance of interstate rates by reason of their relation to intrastate rates, are considerations for the practical judgment of Congress. If the situation has become such that adequate regulation of interstate rates cannot be maintained without imposing requirements with respect to such intrastate rates of interstate carriers as substantially affect interstate rates, it is for Congress to determine, within the limits of its constitutional authority over interstate commerce and its instruments, the measure of the regulation it should apply. It is the function of the Court to interpret and apply the law already enacted, but not, under the guise of construction, to provide a more comprehensive scheme of regulation than Congress has decided upon. Nor, in the absence of federal action, may effect be denied to the laws of the state enacted within the field which it is entitled to occupy until its authority is limited through the exertion of Congress of its paramount institutional power." On the issue of confiscation: "The rate-making power is a legislative power and necessarily implies a range of legislative discretion. The Court does not sit as a board of review to substitute its judgment for that of the Legislature or of the commission lawfully constituted by it as to matters within the province of either. The question is whether, in prescribing a general scheme of rates involving the profitableness of the intrastate operations of the carrier, taken as a whole, the state has superseded the constitutional limit by making the rates confiscatory. The property of the railroad corporation has been devoted to public use. But the state has not seen fit to undertake the service itself, and the private property embarked in it is not placed at the mercy of legislative caprice. It rests secure under the constitutional protection which extends not merely to the title, but to the right to receive just compensation for the services given to the public."

When the decision of the Court was announced, a slump in the stock market occurred, but prices rallied later. Opinions expressed thus far on both sides seem to be in accord with that of the Court, and a decision that appears to be acceptable to all concerned is nothing less than remarkable. The decision gives absolute stability to investments in railroad property. Neither state nor nation may impose rates that will not yield a fair return on the capital invested.

ENGINEERING practice in one branch of the profession frequently finds application in another. Thus the principle of the 'jar-down' machine used in foundry practice for ramming molds is proving beneficial in compacting concrete in forms before the initial set has taken place. In the construction of the Big Meadows dam for the Great Western Power Company, pneumatic hammers were applied to the outside of the forms after the concrete had been poured, thus compacting the mass, making the entire structure homogeneous and sound.

Generated on 2024-09-30 00:24 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

REVIEW OF THE MONTH

WAITING for the final passage of the tariff bill, waiting for the tightness in the money market to relax, waiting for something or other seems to be the keynote for the month. Many drops of water have vanished in the drying-out process that has been under way on Wall Street for some time. Development enterprises continue to go forward in the West, however, and the news of the day is teeming with new projects and betterments for those already in existence.

ANNOUNCEMENT that the California Railroad Commission had authorized the Southern Pacific Company to issue $30,000,000 in new securities to provide funds for improvements has drawn renewed attention to the opportunities in the West. The following summary of the purposes for which the money is to be expended shows that most of the work will be done on the Pacific coast.

Expenditures on Pacific system and Oregon subsidiary lines...	$14,422,565
Grade crossings, including steel viaducts at Sixteenth and Kentucky streets, San Francisco...	122,640
Second main track, between Benicia and Ogden	2,134,120
Machinery, tools, Oakland shipyards, Sacramento shops.....	104,440
Stations, grounds, Los Angeles, San Francisco, Davis, Pajaro..	720,780
Bulkhead and fill, Oakland waterfront	250,430
New lines: Fernby to Lassen, Colusa and Hamilton, Willamette Pacific, Hanford and Summit Lake (extension to Jameson), Porterville Northeastern (extension to Maguesto), Southern Pacific, Dyer to Delhi, O. and C., Salem to Durbin.....	4,982,200

AFTER many months of negotiations during which plan after plan was submitted, only to be thrown into the discard, the Harriman railroad merger has been dissolved. On June 30 the decision of the Federal District Court in session at St. Paul was announced approving the plans agreed upon by the United States Attorney General and the representatives of the Union Pacific Railroad. According to press reports, the plan for the dissolution provides, in brief, that the Union Pacific shall exchange $38,000,000 of its $126,000,000 holdings in the Southern Pacific for the Pennsylvania Railroad's entire holding in the Baltimore & Ohio—virtually an equal amount; that the remaining $88,000,000 shall be sold to the general public through the Central Trust Company of New York; that no present stockholder in the Union Pacific, continuing as such, may buy any of the Southern Pacific stock so sold; that the transaction should begin November 1, 1913, and if not complete by January 1, 1916, the Court should direct the disposition of any Southern Pacific stock remaining unsold. While the Court disregarded the recommendation of the Attorney General that the final decision be withheld for the interposition of any objections that might arise from interested parties, it was stipulated that should any illegal condition arise from the exchange of stock, either under existing or future legislation, or future interpretation by the courts of present statutes, the Government would have the right "freely to assail" the arrangement if the necessity should arise to preserve the separation.

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

THIS marks the beginning of the end of litigation that was instituted at Salt Lake City in 1908. Witnesses were examined in many parts of the United States, and finally a decree holding that the contention of the Government was not sustained was handed down by a majority of the Court, there being one dissenting opinion. The Government then appealed the case to the United States Supreme Court, and in November 1912 a decision was rendered reversing the decision of the lower court, and sending the case back to the United States Court of the District of Utah for enforcing the decree dissolving the merger. Many solutions were offered without arriving at an agreement between the parties. The principal bone of contention was the disposition of the $126,000,000 in Southern Pacific stock held by the Union Pacific Company, although the proposed sale of the Central Pacific Railroad to the Union Pacific Railroad evoked a storm of protest from the West. Now all of these differences appear to have been satisfactorily settled, the eggs have been unscrambled, the ownership of the Central Pacific remaining with the Southern Pacific as heretofore.

HETCH-HETCHY and the water-supply of San Francisco are still being discussed, but prospects for the passage of the Raker bill by Congress at this session seem most encouraging. The bill was introduced in the Senate on June 5 and referred to the Public Lands Committee. Hearings before the House Committee developed some opposition from the Turlock-Modesto irrigation interests, who feared that their water-supply would be jeopardized by the diversion of so large a quantity of water for use in San Francisco. After a series of conferences between the representatives of San Francisco and the irrigation district, a basis of agreement was reached that reconciled all differences. San Francisco has agreed to guarantee 2350 second-feet of water to the Turlock-Modesto irrigation district, and the Raker bill has been amended accordingly.

PROVISIONS in the Hetch-Hetchy bill sanctioned by Mr. Franklin K. Lane are in substance as follows: The Army engineers' report is recommended as the basis for settlement. The quantity of water guaranteed to the irrigationists is 2350 second-feet, but they have a right to use the waste water during flood season up to 4000 second-feet. San Francisco may sell the surplus water to irrigationists after the requirements for the Turlock-Modesto district have been met. The amount of surplus and rates to be charged are to be fixed by the Reclamation Service. When the irrigationists develop enough local storage reservoirs to take care of their needs, the city's obligation ceases. The first installation for the development of power must be made within three years after the completion of the portion of the aqueduct suitable for power purposes, the amount to be developed being 10,000 horse-power. Additions must be made each 5 years thereafter up to 20 years, at which time 60,000 horse-power must be in use by the city or offered for sale. The irrigation districts may buy power at cost for municipal or pumping purposes. The city is required to pay to the Government the percentage required by law for all power sold for commercial purposes. Scenic roads and trails in Hetch-Hetchy valley are to be built by the city. A forfeiture clause is included in the bill providing that should the city neglect

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

to develop the power as prescribed, the Government may exercise the right to lease power privileges to others than the city unless it shall be relieved by the Secretary of the Interior.

THIS agreement removes the last obstacle in the way of a favorable report on the bill by the committee, excepting, of course, the usual opposition from our friends, the so-called 'nature lovers.' The chairman of the House Committee has announced that already he has received many protests from these gentry, and they will undoubtedly fight the passage of the bill with all the forces at their command. How the selfish desire of a few sentimentalists may be considered as paramount to the necessity of supplying a community of nearly a million people with pure drinking water is incomprehensible. The agreement of San Francisco to build scenic roads and trails for the benefit of the nature lovers should they by any chance desire to visit the Hetch-Hetchy valley, seems to be without effect. The bill as amended has not only reconciled all differences heretofore existing with the irrigation interests, but has been endorsed practically without qualification by the Secretary of the Interior, the Secretary of Agriculture, and the Directors of the Reclamation Service, Geological Survey, and the Forest Service. The passage of this bill will vitally affect the future welfare of San Francisco bay cities, and it is to be hoped that Congress may act favorably without delay.

MANUFACTURERS of machinery and accessory apparatus should be prompt in arranging for space at the Panama-Pacific Exposition. Barely eighteen months will elapse before the Exposition gates are thrown open to the public, and the choice of space will necessarily go in the order in which applications are received. From a standpoint of advertising, it would be difficult to conceive of a greater opportunity than is offered to exhibitors of engineering apparatus. An International Electrical Congress and a general International Engineering Congress are to be held in San Francisco during the Exposition year. These will be notable gatherings of men eminent in their respective professions, and who necessarily will be greatly interested in the advanced practice shown by apparatus in the various exhibits. In addition, the annual conventions of the Street Railway Association and of the National Electric Light Association, and of various similar organizations, will be held in San Francisco during 1915. All of these gatherings will include representative men, not only of the United States, but of the entire civilized world. Machinery Hall is exceptionally well adapted to the purpose for which it is to be used. The frontispiece in the June number gave an idea of its magnitude. The clear head-room below the rails of the traveling crane of the three central bays is 50 feet, while that of the wing bays is 40 feet. The floor is designed to carry a load of 200 pounds per square foot and consists of 2-inch plank on joists carried by mud sills. There is, in addition, an auxiliary structure to be called the 'Gas and Fuels' building, in which will be placed such exhibits as boilers, steam-hammers, gas producers, and other apparatus in operation, which by reason of noise or other causes should be excluded from the main building. Docking facilities on the bay front provide for shipments by steamer from all parts of the world. Three railways from the East direct to San Francisco connect with the fair-grounds. The Exposition company, through its traffic manager,

Generated on 2024-09-30 00:26 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

will arrange a schedule that will reduce to one charge all the usual terminal charges for freight in carload or less than carload lots. Warehouse and hauling facilities will also be provided at reasonable charges when required. Cranes for handling light loads will be provided to serve the outer wings having lower head-room. There will be a moderate charge for crane service. General illumination of the building will be cared for by the Exposition company. Any special illumination desired by an exhibitor must be paid for by him, subject to the rules and regulations of the Division of Works. Electric mains for lighting and power will be provided throughout the building by the Exposition company, but exhibitors will be required to provide and pay for service connections, subject to the rules and regulations of the Division of Works. Direct current, 3-wire, 125 and 250-volt service will be available. Motors larger than 2 horse-power will be served with 250-volt direct current only, and direct-current service for motors or apparatus of larger capacity than 25 horse-power must be specially arranged for with the Division of Works. The alternating-current service in the building will be from a 4-wire, 3-phase system, at 60 cycles, with approximately 208 volts between phases and 120 volts to neutral. Single-phase, 120-volt motors exceeding 1 horse-power capacity, and single-phase 208-volt motors exceeding 5 horse-power will not be served. Electric service to a connected load of 2 kilowatts and over will be metered, and the charge for service will consist of a fixed charge per kilowatt of connected load plus a running charge for the energy consumed. Where the connected load consists of motors driving machinery which is exhibited in motion, the fixed charge will be based on the maximum demand and not on capacity of motors. Electric service to a connected load of less than 2 kilowatts will not be metered, and the charge for service will be a flat one, based on the amount of load connected. The rates for electric service will be moderate, and special rates will be made where power is used to show exhibits in operation. Gas, water, compressed air, and steam service will be provided, for which reasonable charges will be made. Steam, compressed air, fuel, or electric current required for any machine in service as a part of the power-plant, will be furnished free when the product is turned over to the Exposition company. This applies to boilers, engines, compressors, ice machines, gas producers, and machine tools, which may be placed as exhibits in the service of the Exposition company. Exhibit space will be ready in July 1914, eight months before the opening of the Exposition, placing the responsibility for being ready on the opening day entirely with the exhibitor. The late-comer will not only find himself at the disadvantage of losing part of the value of his opportunity, but he will suffer from unforeseen delays in traffic, want of time for placing his exhibit at its best, and doubtless from difficulty in obtaining suitable labor to make installation at a time when the best labor is engaged. Exhibit space is too much in demand to allow any procrastinating exhibitor to hold it unduly long without installing his exhibit. The Exposition management and the visiting public have a right to expect all to be ready on the opening day, and the management reserves the right to substitute other space or cancel the allotment absolutely in case of unreasonable delay on the part of an exhibitor. Exhibitors should address Mr. A. M. Hunt for information.

Generated on 2024-09-30 00:20 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

San Francisco Wharf and Dock Construction

By JEROME NEWMAN, M. Am. Soc. C. E.*

SAN FRANCISCO'S waterfront, which extends from the easterly line of the Presidio reservation to the San Mateo county line, is under the jurisdiction of the Board of State Harbor Commissioners. The board has authority to construct piers along this stretch between the waterfront line and the pier-head line, which are established by the federal Government, and are 600 to 800 ft. apart.

The original piers were timber structures supported on wooden piles, and it was soon discovered that these structures were short-lived, due principally to the ravages of the teredo and the limnoria, which necessitated frequent and costly repairs. To increase the life of the piles, several forms of protective covering were used, but without success, owing principally to the destruction of the covering by rough

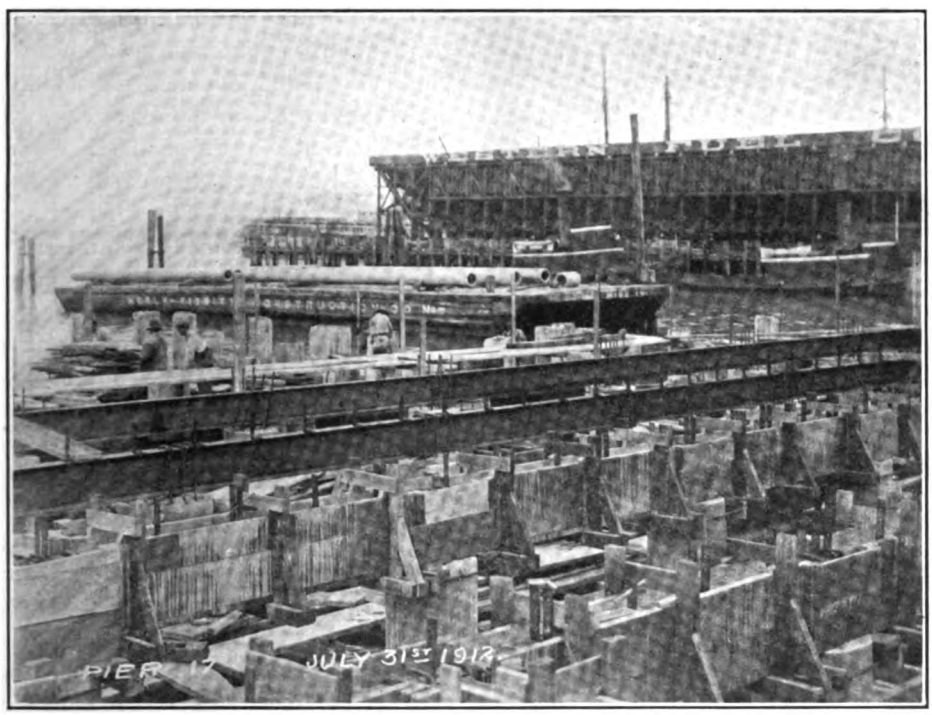


FIG. 1. STEEL AND CONCRETE DECK OF PIER 17.

*Chief Engineer, Board of State Harbor Commissioners, San Francisco.

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

handling, driving, and the impact of vessels and drift. After the abandonment of pile coating, creosote was used, and this resulted in decided improvement, which, however, was not uniform, owing chiefly to the difficulty of obtaining proper oil and treatment.

It was then decided to attempt a supposedly permanent type of construction, and the cylinder pier was adopted. This consisted of several piles enclosed in a steel or wooden-stave cylinder, the piles being surrounded by concrete, which was deposited either under water or in the dry after sealing the bottom with concrete in sacks and pumping out the cylinder. As the concrete was carried down only to the mud line, a lowering of the latter exposed the piles to the attacks of marine worms and resulted in the destruction of the cylinder. The occasional poor quality of the concrete and consequent breakage sometimes caused failure above the mud line.

An improvement on this method was next designed, consisting of a single pile, enclosed in a wooden cylinder, the bottom of which was driven into the mud to the required depth and sealed by means of rope gaskets encircling the pile and carried down by the cylinder. After sealing, the water was pumped out and the space between the pile and the cylinder filled with concrete, reinforced with vertical bars wrapped with wire. This method, while open to some objections, has proved successful, especially in situations where piles of great length are required and where concrete piles, on account of their weight, could not be used.

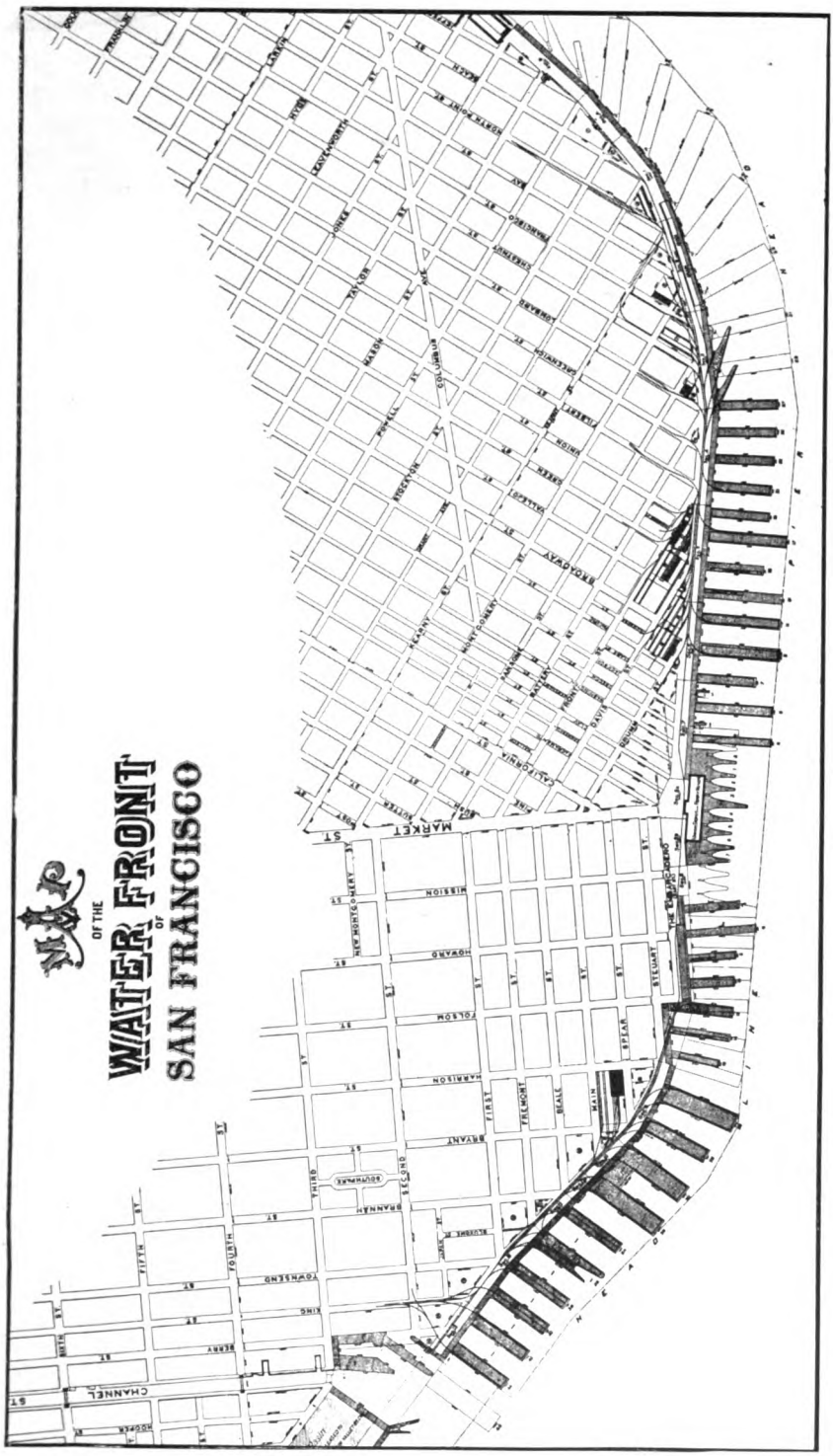
The decks on the older piers were usually of wood, with wooden sheds, but on the cylinder piers first above referred to, some were of steel. The latter, however, on account of lack of attention, have deteriorated and are generally in poor condition.

During the last two years a type of construction has been used, consisting of reinforced concrete cylinders, spaced about 15 ft. on centres and carrying the deck girders and beams, also of reinforced concrete. The girders run transversely across the pier, having the longitudinal beams framed into them, and above the latter is placed the slab. The shed is either of wood or concrete, and is fitted with rolling steel doors which are practically continuous, allowing the handling of cargo with facility for any position of the hatches. The pavement is asphalt, 2 in. thick, except in the driveway, which is in the centre of the shed, where wooden blocks are used, to provide a better footing for teams. The fenders are of the suspended spring type, and are carried at the top by a concrete cantilever beam and at the bottom bear against a concrete block set into the cylinder. The fenders are of treated lumber, with the exception of the sheathing, which is untreated, and are solid at the outer corners, which are rounded to afford easy entrance for vessels.

The construction of these piers presents no novel features, and no great difficulties are encountered except in the foundations and building of the concrete cylinders. The method used in this portion of the work consists in driving a heavy steel cylinder or caisson to the depth necessary to seal the bottom, dredging out the material, and then pumping or bailing out the water; after which the hard bottom is excavated by hand for a foot or more, as may be deemed necessary. This method renders it possible to deposit the concrete in the dry.

After a satisfactory foundation has

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



Generated on 2024-09-30 00:20 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

been reached, a wooden form, 4 ft. high, is set on the bottom for the cylinder base. When this has been placed, the wooden stave form and reinforcement for the cylinder shaft is secured in position, and the concrete poured. After the concrete has set sufficiently, 24 hours being the minimum time required, the steel caisson is pulled up and used again.

Where the bottom is not sufficiently firm to support the piers, piles of the

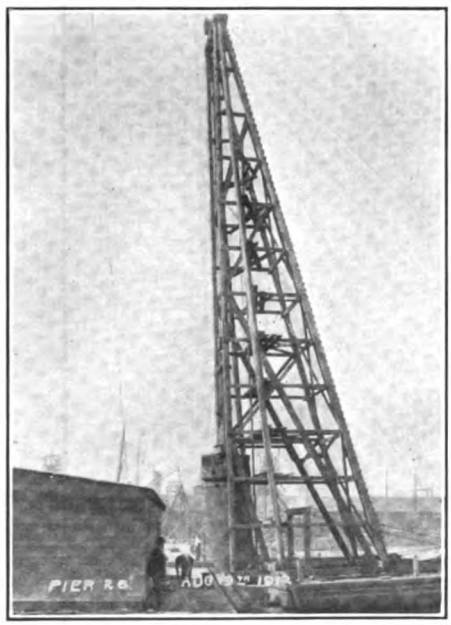


FIG. 2. DRIVING STEEL CAISSON.

proper length are driven inside the steel caisson and cut off so as to leave 5 ft. projecting into the cylinder bases, which are made 8 ft. high. After cutting off, the piles are wrapped with wire cable, the forms placed, and the bases and cylinders concreted.

This portion of the work is extremely difficult and expensive. There is always the possibility of a blow-out, especially in fissured rocky bottom, where it has been necessary to deposit large quantities of clay on the outside of the caissons in order to seal them, as the depositing of concrete under water inside the caisson is not allowed. Heavy equipment and much time are required for driving and subsequent pulling of caissons, some of them being 75 ft. long and weighing from 25 to 30 tons each.

On the piers now under construction between the foot of Harrison street and the foot of Brannan street, the cylinders range in size from 3 to 4 ft. in diameter, with lengths of from 50 to 80 ft., the bases being 5 to 7½ ft. in diameter.

The new pier at the foot of Union street, which was recently completed, is supported on wooden piles, enclosed in concrete cylinders, the piles being cut off at about mean low water. The cylinders are 20 in. inside diameter with 3-in. walls, reinforced with ½-in. round bars. The cylinders are from 45 to 60 ft. in length, and considerable trouble was experienced in handling them, but this was finally overcome by allowing them to remain on the forms 30 days or longer. The space between the pile and the inside of the cylinder was pumped out and then filled with 1:1 cement mortar. The deck consists of steel beams encased in concrete with a wooden floor supported on wooden stringers.

The sheds on freight piers are arranged to provide for the later installation of mechanical freight-handling devices, such as traveling cranes, conveyors, and telphers, which are to be put in by the lessees of the piers.

Sheds on passenger piers are to be two story, with waiting rooms and accommodations for passengers on the second story, the lower story being intended for freight. On freight piers, the height of doors varies from 16 to 22 ft., while on passenger piers, it is 18

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

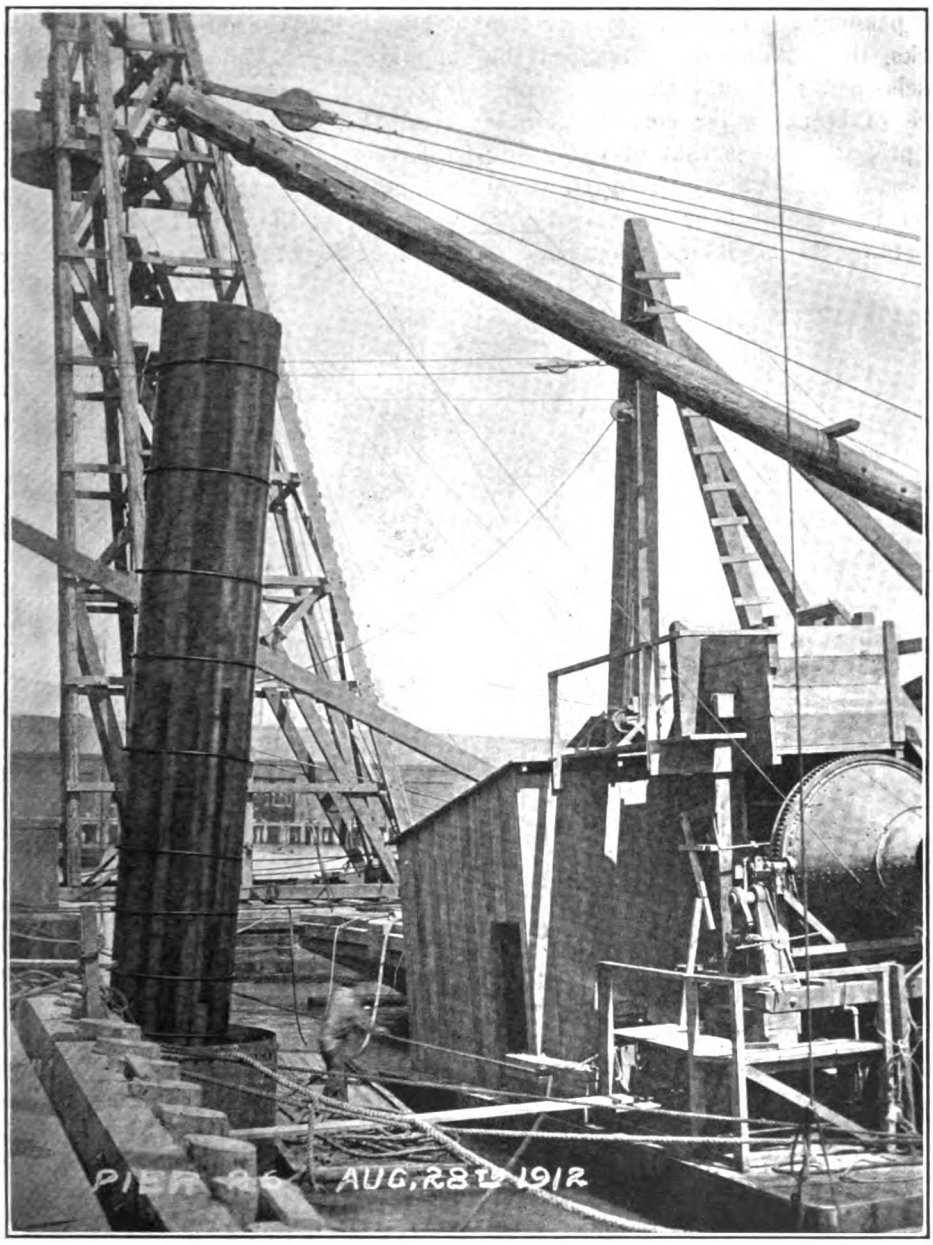


FIG. 3. LOWERING WOOD FORM INSIDE STEEL CAISSON.

ft. The width of piers is variable, depending on situation and the class of vessels which are to use them. Freight piers are from 125 to 200 ft. in width, while piers intended principally for passenger service are from 125 to 140 ft. wide. The length of piers is from 600 to 1000 ft., depending on situation.

All piers, both freight and passenger, are to be provided with railroad tracks, the freight piers having one on each side, outside the shed, one track being

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

a surface track, the other depressed. The passenger piers have one or two tracks, the number depending on the vessels using them. One important piece of work under construction at the present time is that of extending the seawall northerly from Harrison street to a point near Mission street, a distance of 1760 ft. When this is completed, the seawall will be continuous from Taylor street to the northerly line of Channel street.

The seawall consists of a loose rock embankment or a combination of rock embankment and concrete retaining wall. The base rests on hard bottom or clay and sand, at an elevation of 40 to 50 ft. below city base. In the earlier construction, the crest was carried approximately to city base and no concrete wall was used. In some of the recent sections the loose rock embankment extends only to an elevation about 13 ft. below the city base and is surmounted by a concrete retaining wall extending up to street grade.

In the seawall under construction, the rock embankment is placed with the outer toe at the waterfront line and the crest at the curb line, 60 ft. back. It is 44 ft. high, extending to within 6 ft. of street grade, and at its crest is a concrete wall 13 ft. high extending to city base. The permanent bulkhead wharf is being constructed in connection with the seawall or with the new piers. It extends from the concrete retaining wall at the crest of the seawall to the waterfront line, the width being from 27 to 60 ft. The supports are concrete cylinders, protected piles, or reinforced concrete piles, and the deck consists of steel or reinforced concrete beams with a pavement made

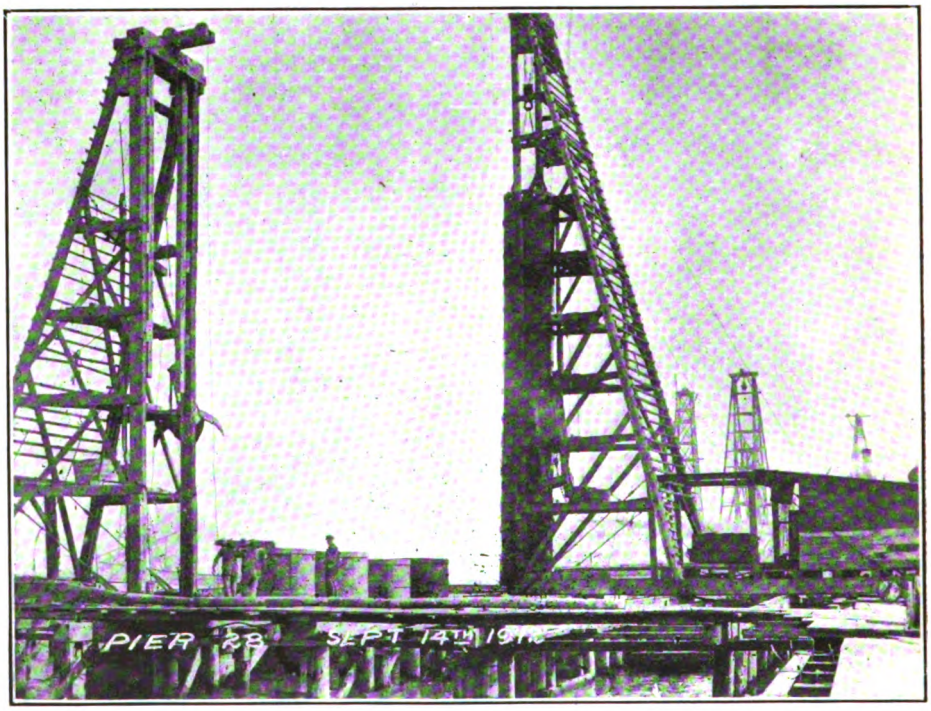


FIG. 4. REMOVING STEEL CAISSON AFTER COMPLETION OF CONCRETE CYLINDER.

Generated on 2024-09-30 00:21 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

entirely of concrete slab and asphalt.

To accommodate the increasing passenger traffic from the east and north sides of the bay, four new passenger ferry slips are contemplated, one north and three south of the Ferry building. The cost of the improvements under way at the present time will be about as follows: Pier 17, $286,000; pier 26, $608,000; pier 28, $460,000; piers 30 and 32, $1,232,000; seawall, $544,000; pier 39, $750,000; a total of $3,880,000.

The cost of piers constructed as above described is about $3.50 to $4.50 per square foot of deck area, depending on depth and character of foundation, type of shed, etc. The cost of the bulkhead wharf is $2.50 to $3 per square foot, and the cost of the seawall and bulkhead wharf is approximately $310 per lineal foot, equivalent to about $5 per square foot.

Assuming the cost of a creosoted pile pier at $1 per square foot with a life of 12 years, and that of a reinforced concrete pier at $3.25 per square foot with a life of 100 years, the comparative annual charges for the two types of construction are approximately as follows:

	Creosoted pile.	Reinforced concrete.
Interest at 4½%	$0.0450	$0.1463
Maintenance, assumed	0.0500	0.0125
Replacement, 12 years	0.0681	.....
Sinking fund, 75 years	0.0022	0.0077
Insurance	0.0060	.....
Total per square foot	$0.1719	$0.1665

This would indicate that the annual cost is very nearly the same for the two classes.

The map shows the improvements under way and proposed, the latter being indicated in light lines. At the end of Channel street, it is intended to construct a pier 200 ft. wide and 800 ft. long. The four piers extending from the foot of Brannan street to near Harrison street are under construction, and five new ones are projected between Harrison street and Howard street to take the place of those at present in use, which are in bad condition. Between Lombard and Stockton streets, seven new piers are to be built, and in conjunction with this work, the present car ferry slips are northerly to Mason street.

Fig. 1 shows the steel and concrete deck of pier 17, with steel beams in position and concrete forms placed. This is the pier at the foot of Union street which has recently been completed. This photograph was taken on July 31, 1912. Position of all piers is shown on the map.

Fig. 2 shows the driving of a steel caisson at Pier 26, August 19, 1912.

Fig. 3 shows the lowering into place inside the steel caisson of the wooden cylinder form for concrete at Pier 26, August 28, 1912.

Fig. 4 shows a steel caisson being pulled up after the concrete cylinder is completed at Pier 28, September 14, 1912.

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Numbering Systems*

By RAOUL BRICARD

'INTEGRAL number' or 'integer' is a word by which one answers the questions 'How much?' or 'How many?' Numbering is a method that makes possible the naming and the writing of all integers, and, by convention, of fractions. Since man first recognized the important rôle that numbers play in human interrelations, he has endeavored to invent numbering systems.

It is not possible to separate completely the history of spoken and written numbers. Apparently, man having acquired a conception of numbers, soon looked for means by which to represent them. The simplest numbering system is the use of similar objects repeated a sufficient number of times: fingers, stones, strokes upon a board or pole, etc. This is the primitive numbering system used by savages and the ancients. For example, according to Livy, the Etruscans and Romans marked the year by driving a nail in some sacred spot. Even now in some countries, bakers calculate by strokes upon a shelf the number of loaves sold to every customer. There should also be mentioned the use of the primitive numbering system for playing cards, dice, or dominoes. Finally, the repetition of some sound by a clock, to strike the hour, belongs to the same system

Orally, the primitive numbering system consists of the arbitrary naming of a number. Of course, this system soon becomes useless for writing and for speaking of somewhat large numbers. Very long ago, men realized more or less clearly the superiority of the present n-system of numbering, or a system to the base n, the principles of which more correctly will be stated in mathematical form. Let n, an integer, be given, which we will call the base of the system, and N, any integer. Then always and uniformly can be written

$$N = a_0 + a_1 n + a_2 n^2 + \ldots + a_k n^k,$$

where the coefficients $a_0, a_1, a_2, \ldots a_k$ always are zero or integers less than n. Of course, this principle was applied earlier to spoken numbers than to written numbers. Inasmuch as, *a priori*, the base n can be arbitrarily chosen, the possible systems are infinitely many. The best known system in the world is the decimal system ($n = 10$), doubtless because we have 10 fingers; a fact that, no doubt, played a large part in the choice of the number 10. But many languages still preserve the impress of the other systems; for example, that of the score ($n = 20$), possibly a relic of the time when man calculated by the toes as well as by the fingers. The Celts apparently used a 20 system more or less complete. In the present language of Brittany, the numbers 40, 60, 80, 120, 140, 160 are named, respectively, *daou-ugent*, *tri-ugent*, . . . *eiz-ugent* (two 20's, three 20's, . . . eight 20's). The present French language, possibly under the

*Original in *Scienca Gazeto*, published in Esperanto, January 1913. Translated by A. H. Babcock.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Celtic influence, says *quatre-vingts* (four 20's = 80); the old texts give the forms *trois-vingts* (60), *six-vingts* (120), *sept-vingts* (140), *huit-vingts* (160), *douze-vingts* (240), *quatorze-vingts* (280), *quinze-vingts* (300). Also, the Aztecs denote by special signs, the numbers from 1 up to 19, and the numbers 20, $400 = 20^2$, $8000 = 20^3$. Some other inheritances from the early systems are worthy of note. The Bretons call the number 18, *tri-ouec'h* (three 6's), (the 6 system). All of us often speak of dozens, grosses ($144 = 12^2$); even, at least in France, some dealers give the name *maso* to the number $1728 = 12^3$ (12-system). Curious it is that the savages of New Zealand have special names for the numbers 11: $121 = 11^2$, $1331 = 11^3$ (11-system).

But, of all the numbering systems having bases other than 10, the most important is the base 60, still used for the division of time and of the circle. It certainly has a Chaldean origin. In 1854 there were found at Senkare, near the river Euphrates, two tablets which date at least from 1600 B.C. They contain the tables of the squares up to $3600 = 60^2$, and the cubes up to $32768 = 32^3$, expressed as to the base 60. For example, the square of 8 is indicated by the sign for the number 1 followed by the sign for the number 4; the square of 9 is denoted by the sign for 1 followed by the sign for 21. This will hardly be understood unless it is written

$$8^2 = 1 \times 60 + 4; 9^2 = 1 \times 60 + 21.$$

What prompted the Chaldeans to use the base 60? This can be only conjectured. Possibly, the 60 numbering system appeared to them especially useful in astronomical calculations. The lunar month contains approximately $30 = \frac{1}{2}$ of 60 days; the solar year contains approximately $360 = 6 \times 60$ days

Ancient Numbering Systems. — The ancient Egyptians wrote in hieroglyphics the nine first numbers by 1, 2, . . . 9 strokes, according to the names of the numbers.

The Greeks, up to the third century before our era, wrote numbers by their names. They later used some kind of a decimal system different from ours. By 27 letters, the first 24 letters of their alphabet and 3 letters of Oriental origin, they wrote the nine first units, the nine first tens, and the nine first hundreds. In this manner, three letters at most represented any number less than 1000. The whole was written under a vinculum. The nine first letters to the left of a comma represented thousands. The sign of the number 10,000 was the letter M, or a period. The Roman system is too well known to require a description. We still use it to write dates, hours, the numbers of volumes, etc. The characters, borrowed from the Etruscans, possibly had an oriental (Egyptian) origin. This system is capricious, and is less logical than the Greek. The Greek and Roman systems, principally the latter, were not adaptable for calculations. On account of this, the ancients used a mechanical device called the abacus, which consisted of little shelves upon which markers were manipulated according to vertical lines. Any markers placed upon a line of m^a rank (to the right or left) had a value of $10^{m-1}n$ units. This obviously was the principle of position itself, which controls our present numbering systems.

Even long after the introduction of the Arabic system, the abacus was used, approximately up to the end of the eighteenth century. For example, Moliere, in his famous comedy *Le Malade Imaginaire*, shows the chief character "with a table before him, calculating

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

by markers." The Orientals today use the *suanpan* or the *soroban*, some kind of abacus, on which small spheres are strung on wires.

Discovery of Zero.—As we have just stated, the representation of numbers by the abacus determined the principles of our numbering system. However, it lacked something, apparently not important, but necessary to enable the writing of all numbers—it was the figure 0. Many centuries passed before some unknown genius made this small discovery by means of which calculation was originated. The only certain knowledge concerning him is that apparently he was a Hindu and that he lived between the sixth and the eighth centuries. The mathematician Aryabhata, born in 476, knew the principles of position, but not yet the whole present system. The figure 0 first appeared in a Hindoo document in the year 738. Soon afterward the decimal system was introduced into Arabia, where it was generally known in the tenth century. It reached Latin Europe in the eleventh century. At that time those who calculated in Arabic fashion were known as 'Algoritmists' (a name derived from that of the Arabian mathematician Alhovaresmi). Those who used the abacus remained faithful to their ancient method.

Little is known as to the derivation of the forms of the figures, because these forms varied greatly from time to time, and became definite only after the invention of printing. Two different forms for the figure 5 are still in use. Possibly the easiest explanation is that the nine figures apparently come from the 'apices' of the abacus. These 'apices' were signs written upon the markers to show their values.

Is the Decimal System the Most Useful?—Is the decimal system the best of all possible systems and the most suitable for calculation? Concerning the principle of position which controls it, the answer apparently cannot be questioned. Other principles could be applied; for example, that of the Roman system, but none of them would make possible the formation of rules as simple, relative to the fundamental operations. But, as has been stated, the principle of position could be used for any base whatever, so that the question now is, is the base 10 the best adapted to supply our needs?

To those who are interested in a complete answer to this question, is recommended a perusal of the long and interesting article, written in French, by L.-G. du Pasquier in the review *L'Enseignement Mathematique* (Geneva and Paris, 1911; p. 265). Here it is possible to make only a brief review of it.

If the base n is used, any number can be written by the figures 0, 1, 2, . . . n-1. For example, in the system to the base 3, the 10 first numbers are written:

1, 2, 10, 11, 12, 20, 21, 22, 100, 101.

The simplest of all systems is that of the base 2, which uses only the figures 0 and 1.

It can be stated generally that the writing of any number is longer as the base is smaller; for example, the same number is now written according to the base—2, 6 and 10:

101001010111,
20131,
2647.

It is easy to prove that the number of figures necessary to write any given number is approximately inversely as the logarithm of the base. Because it is tedious to write and to speak, and difficult to remember a number consisting of many characters, a base as large as possible is chosen. Unfortunately,

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

other considerations, at least as important, prompt to the contrary decision: namely, the ease of calculation.

Really, to make calculations by numbers written in the n system, it is necsary to learn by heart two fundamental tables: addition, which gives the sum of all pairs of numbers from $1 + 1$ up to $(n\text{-}1) + (n\text{-}1)$, and the multiplication table, which gives the products of all pairs of numbers from 2 by 2 up to $(n\text{-}1)$ by $(n\text{-}1)$. By a simple calculation it is determined that the total number of results contained in both tables is $(n\text{-}1)^2$. For example, to calculate by the decimal system it is necessary to remember 81 number results. It can be remarked further that this by-heart knowledge must be so perfect that it is used by instinct; in such fashion, for example, that when the question is asked, 'What is 7 by 8?' there will come without hesitation the answer, '56.'

Memory capacity has its limits, which often are not far off. It is very apparent that the decimal system charges too heavily the memories of many men, even intelligent, to whom the addition table, and possibly the multiplication table, never become perfectly known. How many men successfully can calculate the square of the number 689754 quickly and with entire confidence in the accuracy of the result, until the work has been checked?

It can thus be seen that the decimal system condemns the majority of men to a lifelong lack of skill in arithmetical calculations. This being the case, the conclusion may be reached that a base less than 10 is to be preferred, and that the benefits obtained in this manner relative to the ease of calculation, doubtless would be greater than the difficulties which would result from the lack of knowledge of these numbers.

A third somewhat weighty consideration is that of the fraction. Division by an integer whose prime factors belong to the base, always will give a quotient that can be exactly written; that is, represented by a finite number of figures. If the divisor has other prime factors, the quotient generally cannot be exactly written. Now, evidently, division by an integer or a fraction is the more frequently encountered as the divisor becomes smaller. Division by 2 is required more often than by 3, and by 3 more often than by 4, etc. It can be stated, therefore, of the decimal system that it always makes possible a division by 5 and not always a division by 3. This difficulty, considering the division by 3, prompts some men to consider a system to the base of 12, but, for the reasons given above, this base, necessitating the memorizing of $11^2 = 121$ results, would be even a greater tax on the memory than the base 10.

It is safe to conclude, therefore, that if ever man changes his numbering system, the base chosen will be a number less than 10. It must be an even number to permit division by 2. 2 can be rejected at once on account of the great number of characters required to write numbers in this system. 8 is too near 10 to make the change with real profit. There remain 4 and 6, between which one may hesitate. The base 6 permits division by 3. On the other hand, the base 4 is suggested by the simplicity of calculation in this system, in which there are required only nine rules—six for addition,

$$1 + 1 = 2,\ 1 + 2 = 3,\ 1 + 3 = 10,$$
$$2 + 2 = 10,\ 2 + 3 = 11,\ 3 + 3 = 12,$$

and three for multiplication,

$$2 \times 2 = 10,\ 2 \times 3 = 12,\ 3 \times 3 = 21.$$

The length of numbers in the 4-system is permissible: numbers of 6 figures

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

in our decimal system would become 9 and 10 figures.†

Both systems have partisans: the 4-system and the 6-system. The most enthusiastic of the latter is Professor Lehmann, at Leipsic, who gave the better part of his life to this propaganda, invented new figures and numbers, published logarithm tables in the 6-system, etc. On the other hand, a very ardent advocate of the 4-system is Thiele, of Copenhagen, who long ago investigated different systems and finally became convinced of the superiority of the 4-system.

Possibly the time will come when progressive men will forsake the old decimal system, which man owes to his anatomical form. It will produce very important changes in our systems of weights and measures, etc. It is difficult to get men to agree to a reform, concerning which there can be so much difference of opinion. Apparently, there will be developed two great parties, those who favor the 4 and the 6-systems, but there will not be any tendency toward the cumbersome 12-system and the fantastic 2-system. Possibly it is not very urgent to attempt to predict which one will win in this arithmetical battle.

Shipping and Sampling Crude Oil

By PAUL M. PAINE*

THE bulk of crude oil production is shipped from the producing properties through the various pipe-line systems. A smaller fraction goes out in tank cars, and a still smaller quantity, from producing fields along coast lines, is placed directly in vessels for transportation by water. Tank cars have capacities ranging from 250 to 300 bbl. of 42 gal. each. Ordinarily they do not belong to the railroads, aside from those used for traffic operations, but are supplied by either the buyer or seller. Each car has a number, and these numbers, with the capacities expressed in gallons, are recorded in a book in which nearly every tank car in the country is listed. Freight charges are based on the weight of the oil. The weight is computed from an arbitrary standard established in various parts of the country for the particular commodity carried in the car. The weights of California crude oil and field toppings both are determined from a rating of 7¾ lb. per gallon, regardless of what the actual weight may be. The proportion marketed by this method, however, is small compared with the sales to the major pipe-line companies.

Sales are made in several forms of contracts. They may be for a definite quantity, with no time limit within which the oil is to be delivered; or for a maximum number of barrels per day or week over a stated period of six months, a year, or more. The price may be set irrespective of quality with-

†It is a remarkable fact in this connection that the aboriginal Hawaiians and kindred races of the South Pacific archipelago used a number system to the base 4.—TRANSLATOR.

*Honolulu Con. Oil Co., Fellows, California.

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

in very broad limits, or it may be, and more often is, determined by a sliding scale so that a higher value is placed on the grades containing a greater percentage of the lighter and more valuable constituents. Contracts invariably specify the wells or property from which the oil purchased is to be obtained, and buyers keep a careful watch to be sure that the oil they are taking has been produced from the wells specified and not from those of some other property. The occasion for this arises from the fact that the value of petroleum is constantly changing, and a producer may have a contract that was made when oil was high, and yet not have the production with which to take advantage of it; while a neighbor who has a contract at a lower figure may have a large production and might naturally desire to market his oil through the first operator and receive the additional margin in price. Other clauses usually inserted in contracts relate to the temperature basis, the minimum amount to be delivered in a single shipment, the maximum allowable percentage of foreign matter in the oil, and the conditions regarding pumps and piping connected with the mechanical part of shipping.

Crude oil is bought at a temperature of 60°F., and a correction at the rate of 1% for every 20°F. above this is deducted. The coefficient of expansion of petroleum varies somewhat with different oils, yet it is seldom as great as that indicated by this correction. While the correction works both ways, that is, an addition is made when the temperature is below 60°F., in general a slight loss is suffered through this by the shipper. Ordinarily the oil is not accepted if the percentage of impurities, including water, sand, and foreign matter, is greater than 2%, although this limit is not infrequently increased, especially when the production from a gusher is so great that the oil must be shipped before it has had time to stand and allow the impurities to settle and be drawn off. In determining the net amount in a shipment, the temperature correction is first made, and from the net thus obtained the deduction for impurities is taken, leaving the final net amount.

In the East much of the oil is shipped from wood tanks of from 100 to 250 bbl. capacity, and neither of the corrections cited above are made, the buyer's gauger simply satisfying himself that the level of water that has settled to the bottom of the tank is below that of the tank discharge. In the West the shipping tanks commonly used hold 1000, 2000, 5000, or 10,000 bbl. Larger amounts than these in single shipments are not looked on with favor, although shipments of 55,000 bbl. are not unusual. Some buying companies prefer to supply the shipping pump and to put in all the piping from their main line to the tanks; others require that the shipper install the pump and connections between it and the tanks. In either case the steam and labor connected with shipping are furnished by the seller. The type of pump used is entirely a matter of the character of the oil as regards viscosity, specific gravity, and the pressure to be met. In deciding the size for any particular work, the published capacities for water service should be discounted, as it is rare, when pumping oil, that a greater volumetric efficiency is obtained than 85% of the rated capacity of the pump for water.

Tanks up to and including 2000 bbl. capacity are usually constructed of galvanized iron, either plain or corrugated. The larger types are of sheet steel,

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

riveted in courses of 5 ft. The roof structure is supported by wood posts resting on the tank bottom, and which, in the larger sizes, are frequently held in place by light wire-rope guys. Tanks receiving the heavier grades of oil, that require heating in winter before they may be pumped, are equipped with coils at the bottom, with steam intake and discharge connections on the outside. Other connections attached to the tank are the discharge, placed from 8 to 14 in. above the bottom; the water drain, usually on a bottom plate near the outside edge, and two sample cocks, one at the same height from the bottom as the centre of the discharge opening and the other half way between this point and the top. By making the discharge connections as shown in Fig. 1, using a tee and plug where the line turns down instead of an ell, any material that lodges in the seat of the gate-valve and prevents it from being fully closed may be readily removed by taking out the plug in the end of the tee. Before using a tank it should be carefully cleaned of all loose wood or other obstructions, and the discharge opening screened, to prevent material from passing through and interfering with the pump valves.

Tanks should have a firm, level foundation, and the larger sizes are never erected on filled ground when this can be avoided. After the grade has been prepared, a deep furrow is plowed all over it and the loose ground rolled, to overcome the effect of gopher holes. When oil-sand may be obtained, it is placed from 3 to 6 in. deep to prevent corrosion of the tank bottom. The material removed in grading is usually thrown up around the tank for a fire levee.

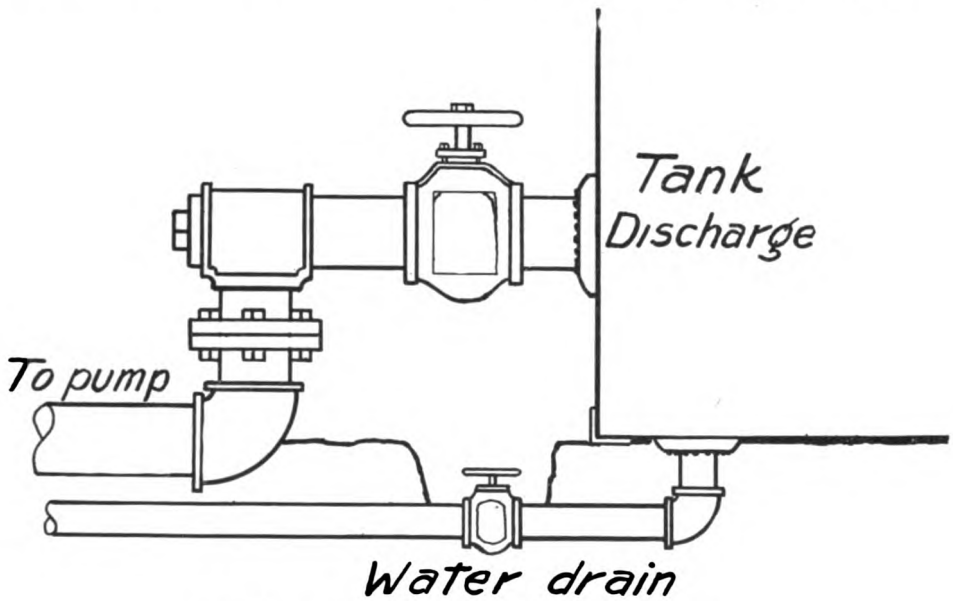


FIG. 1. TANK DISCHARGE CONNECTIONS TO PUMP.

When the construction of a shipping tank is completed, representatives of the buying company and the shipper owning the tank meet for the purpose of 'strapping' it. The circumferences at a number of definite distances from the bottom are measured, and all other

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

data bearing on the capacity are noted, such as the dimensions and positions of the roof supports, known as the 'dead wood,' the size and position of heater coils, thickness of side plates, etc. From these there is computed the gauge sheet, showing the exact number of barrels to two decimal points for each inch in height from the bottom. Average interpolated values for each eighth of an inch are determined, and usually set off in a separate column on the sheet.

When a tank is filled and ready for shipment, the buyer's gauger measures its height; this is known as the high or 'front' gauge. He reads the temperature on a thermometer suspended in the oil, takes samples, closes and locks the valves on all other tank discharges connecting to the same pump suction line, and the oil is then pumped out until its surface is level with the discharge opening. The gauger then measures the low or 'back' gauge and delivers a paper, known as the 'run ticket,' which shows the high and low gauges, gravity, temperature, and 'cut' (percentage of impurities) as determined from the samples. The difference between the amounts on the gauge sheet representing the high and low gauges shows the number of barrels gross shipped, and the correction as described above gives the barrels net on which settlement is made.

Ordinarily only the three tests cited above, namely, temperature, gravity, and impurities, are made in buying oil from the producer. The temperature is read from a thermometer suspended by a cord from the roof, so that it hangs midway in the tank. The gravity is designated according to the Baumé scale and is determined by the Baumé hydrometer, a narrow glass column which, when immersed, sinks to a depth dependent on the density of the oil. A scale on the glass gives a direct reading of the gravity except for a temperature correction that must be made if above or below 60°F. This correction varies with oils of different gravities, and the published tables of corrections must be used when precision is desired. In ordinary oil field work a reduction of 1° gravity for every 20° of temperature above 60°F. is sufficiently exact with oils ranging around 18°B. The correction decreases with the lighter oils, and is 1° gravity for every 16° in temperature for 25°B. oil. Degrees Baumé may be converted to specific gravity by adding 130 to the Baumé degrees and dividing this by 140.

The percentage of impurities is found by means of any one of several forms of centrifugal machines which give a whirling motion to glass tubes containing a mixture of gasoline and oil. When the machine is turned rapidly, the tubes assume a horizontal position and the impurities, which are heavier than the mixture of oil and gasoline, are thrown to the bottom. The action is similar to that of a cream separator. The glass tubes in common use contain 100 c.c. and are etched with graduations by which a direct reading may be obtained. The usual mixture is to use 50 c.c. of oil and 50 c.c. of gasoline.

The sampling of a tank may be carried out by taking small portions from the pump discharge at regular intervals, by samples from the sample cocks on the side of the tank, or by the use of a 'thief', an instrument with which they may be secured from any point within the tank. Several devices for this purpose are made, all along the line of the simple one shown in Fig. 2, which is a piece of 2½-in. pipe with an inside ring holding a swinging valve.

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

The valve works freely on a hinge, which allows it to swing up when the 'thief' is being lowered and permits the oil to pass up through the pipe. When

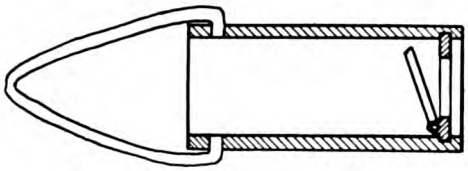


FIG. 2. OIL SAMPLING DEVICE.

the pipe is pulled up, the valve falls and holds the oil contained in the pipe at that point.

The method of sampling from the pump discharge is rarely followed, and the determination of the tank contents is usually based on three samples, one from the sample cock, level with the centre of the discharge opening, one from the sample cock half way up, and the third taken from the surface of the oil. Frequently only enough oil is taken from each of these points so that the three together barely fill a quart jar, in which case they are sometimes put together and one analysis made of the mixture. At other times a larger quantity may be taken from each point, each sample kept intact, and three analyses made and averaged, but in either case the result is subject to a greater or lesser error, as will be shown later, due to the fact that, in virtue of the uneven distribution of the impurities in the oil, the three samples do not furnish a true sample of the tank contents.

No 'umpire' samples, similar to those provided shippers of ore, are ordinarily taken, and the scarcity of disagreements between shippers and buyers testifies rather to the good-natured efforts of both to meet each other half way than any merits in the usual methods of sampling.

The production from nearly all wells contains varying small percentages of water, sand, etc., which usually settle readily to the bottom of the tank and may be drawn off through the drain, unless the oil and water have become emulsified so that the water is held in suspension. In this case one of the several processes of dehydration must be employed to throw it down. Aside from the emulsified oil, the readiness with which the water settles varies largely with the gravity, viscosity, and other physical characteristics of the oil. The percentage, therefore, at any given point in a tank is not a constant, but changes as the tank contents adjust themselves with respect to their specific gravities. The points in the full line of Fig. 3 represent the percentage of water, which in this case was the only impurity present, in samples taken with a 'thief' at every foot above the discharge in a tank containing 9672.79 bbl. The period of filling the tank was about six days, and the samples were taken at from two to four hours after it had been completely filled. During the time that the tank was filling, such of it as could be drawn off at the bottom was allowed to escape. It is evident from the analyses that the decrease in water content is not a uniform ratio with the height in the tank, and analogous curves have been found in sampling tanks of both greater and less capacities than the one in this case.

This tank of oil was allowed to stand for 48 hours and as much water drawn off during this time as could be drained without a loss of oil with it. The loss by drainage and evaporation during this period was 16.97 bbl. Samples were then 'thiefed' again at every foot above the discharge, and their analyses are shown by the dotted line in Fig. 3. Consideration of these analyses shows that the average actual percentage of

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

water at the time of the first sampling was 0.774%. The three samples by which the water content would have been determined by the buyer, taken from opposite the discharge, half way up and at the top, average 1.2%, an excess of 55% due to this method of sampling.

After the 48-hour period had elapsed, the actual percentage of water, as shown by the second set of 24 samples, was 0.343%, and the average of the buyer's three samples was 0.567%, an excess of 65%. From this it might appear that the most favorable time for the producer to have shipped the oil was at the time the first samples were taken, since the vitiation of the result is seen to increase with the length of time that the oil stands in the tank—a rule that I have found to obtain in nearly all cases. In this connection, however, it should be noted that the loss by draining during the 48 hours does not check with the indicated decrease in the percentage of water, due to the fact that it is mechanically impossible to draw off all the water that has settled to the bottom of the tank. This water, by reason of its greater specific gravity, has displaced oil that was previously at the bottom, and being situated below the level of the discharge opening, it does not appear in the second series of samples.

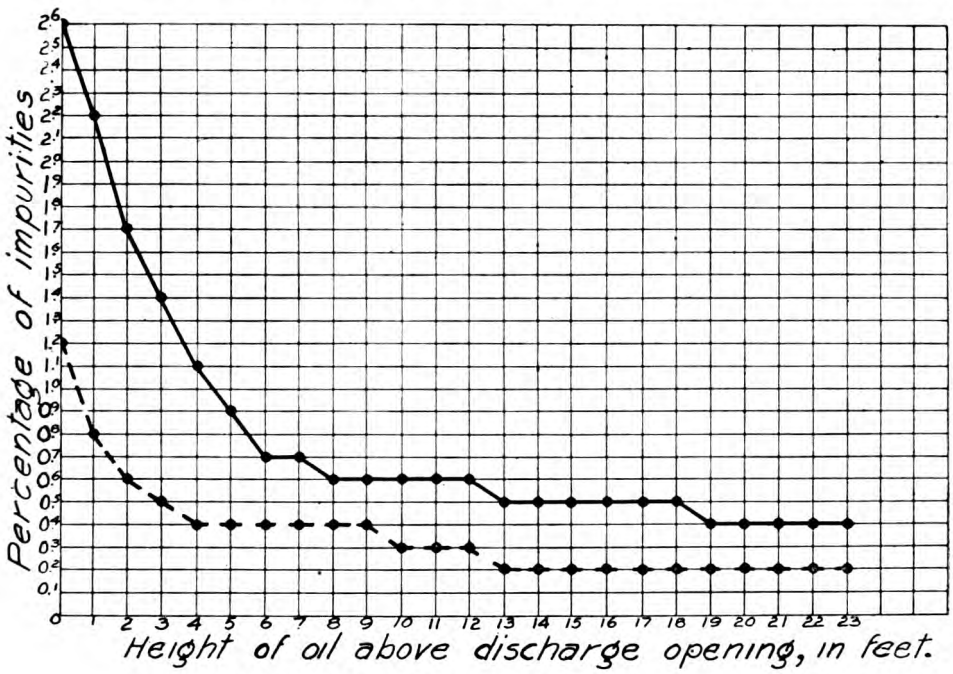


FIG. 3. CURVE SHOWING RESULT OF SAMPLING A 9600-BARREL TANK.

Assuming that the oil shipped in this case amounted to 9200 bbl., the deduction that would have been made by the buyer for the water percentage at the time of the first sampling would have been 1.2%, or 110.4 bbl. By allowing the oil to stand for two days before shipping, this was reduced to approximately 0.6%, or 55.2 bbl., a difference of about 55 bbl., against which must be charged the loss by drainage and evaporation of 17 bbl., leaving a balance of 38 bbl. gained by the producer

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

in the sale of his oil, at no added expense. It is true that the difference is not great, but the error appears to be always in favor of the buyer, and when shipments of this size are made frequently, or the water content is greater than that shown in the case cited, the aggregate amount represented is not inconsiderable. Conditions on no two properties are exactly alike, and no set rule for handling oil in storage may be safely established, but the investigation outlined above is simple and may easily be carried out by the producer interested in securing the most efficient method for handling his oil in order that the highest possible return may be obtained from the buyer.

City Waterway Bridge, Tacoma

By JOHN LYLE HARRINGTON*

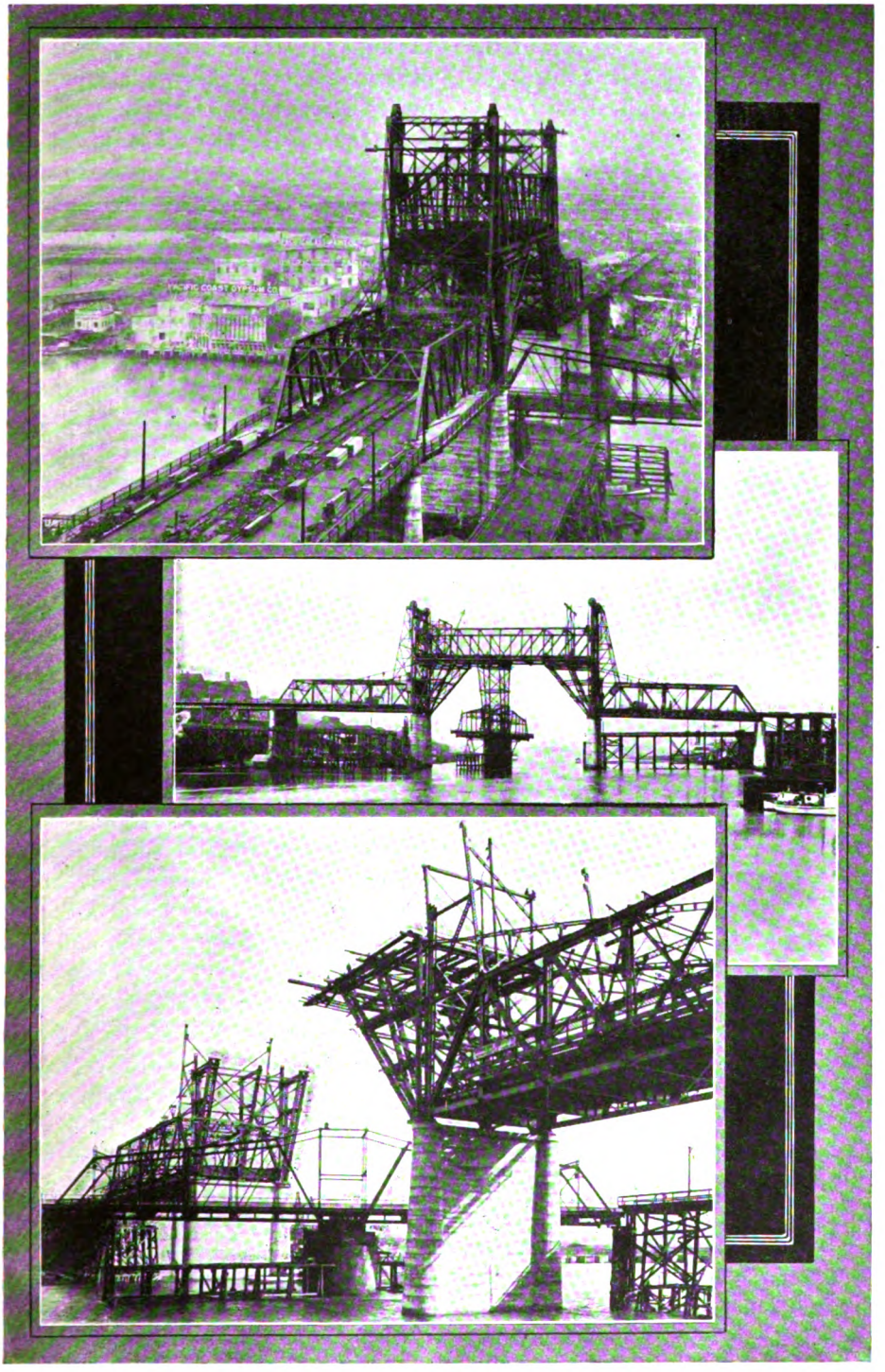
THE Waterway bridge in the city of Tacoma connects the business centre on the hill with the manufacturing centre on the tide flats, and occupies the line of Eleventh street. The upper deck has a 50-ft. clear roadway and two 10-ft. clear sidewalks, extending on a slight up-grade from A street to Cliff avenue, in order to clear the railway tracks on Cliff avenue, thence on a down-grade of from 2½ to 4% over the tracks of the Northern Pacific railway across the city waterway, and down to the clear level on the north side of the waterway. The lower deck has a 19-ft. 4-in. clear roadway and a 10-ft. sidewalk extending on a heavy grade from the top of the hill at Cliff avenue down to the city waterway, and turning back and widening down to the level of the railroad tracks and streets on the south side of the waterway. The approach on the north side consists of about 100 ft. of reinforced concrete retaining walls and about 575 ft. of steel girder and column viaduct. The north approach consists of timber trestle, and the main bridge over the river consists of two 190-ft. fixed truss spans and a 220-ft. vertical lift span, affording a clear waterway 200 ft. wide. The vertical clearance beneath the lift span at high tide is 60 ft. when the span is down and 135 ft. when the span is up, or, since there is 20 ft. of tide, the clearance is 80 ft. with the span down or 155 ft. with the span up at low tide.

A 16-ft. water main is brought up the shore piers, carried over the top of the trusses of the fixed spans, thence up the back of the towers and over the lift span, on a light truss provided for that purpose. The upper deck is paved with creosoted wood blocks or creosoted plank, which in turn are supported on creosoted ties. The sidewalks are all untreated plank. The double track street railway is placed in the centre of the roadway. The lower deck in the south approach is paved with untreated plank 4 in. thick.

The piers are sunk by the open dredging process to about 35 ft. below low water, and the piles on which the

*Consulting Engineer, Kansas City, Missouri.

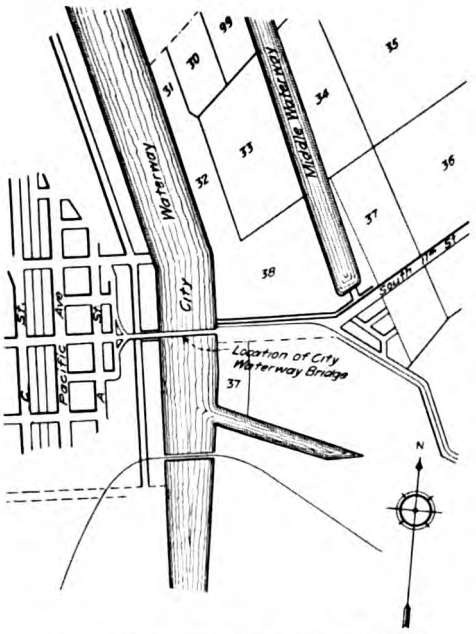
Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



VIEWS OF THE TACOMA CITY WATERWAY BRIDGE IN VARIOUS STAGES OF CONSTRUCTION.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

piers are supported, are carried to a depth of about 115 ft. below low water in the deepest case. The shafts of the piers consist of frustums of two cones, connected through their height by reinforced concrete webs. This construction was adopted to lessen the load on the piles and bases, for the shafts of the piers vary in height from 72 ft. above the bases of pier No. 4 to 90 ft. above the bases on pier No. 1.



POSITION OF CITY WATERWAY BRIDGE.

The lift span consists of a simple truss span suspended at its four corners by wire ropes which rise over cast steel sheaves 9 ft. in diameter and connect to concrete counterweights, which balance the span. Each corner of the span is suspended by sixteen 1½ in. diameter plow steel ropes, connected rigidly to the span and to the counterweight through a system of equalizing levers, by which the load is equally distributed over the entire group of sixteen ropes. The operating machinery is mounted in a house placed above the centre of the lift span. The machinery consists of four drums actuated through a train of gears by two street railway motors operating on 500 volts direct current. Each drum carries two ropes, one of which runs from the drum underneath a sheave on the corner of the span and connects to the top of the tower, while the other runs from the top of the drum over the same sheave at the corner of the span and connects to the bottom of the tower. All four drums are similarly connected, each to its corner. The turning of the drums winds the ropes leading to the tops of the towers and lifts the span, while the ropes leading to the bottom of the towers are paid off. Reversal of the direction of rotation of the drums brings the span back to its seat.

The motors are operated by series magnetic controller placed in an operator's cabin situated just north of the sidewalk, where the operator can have a clear view of both the waterway and the roadway. When the span reaches the upper and lower limit of its travel, the electric current is automatically cut off and solenoid brakes are automatically applied, but the operator has hand brakes as a safeguard.

In the fixed spans at each end of the lift span there are two electrically operated gates, which stop the traffic. Two are lowered, and at the same time swung across the roadway to stop traffic from going onto the span, and when the traffic on the span has been cleared the other two gates are closed. The gates are operated by the bridge operator from his cabin.

The site of this bridge was previously occupied by a light and inadequate swing span with a steel approach extending to Cliff avenue on the south, and a wooden approach extending to the tide flats on the north. Its position

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

was much closer to the waterway than the present span, hence, in order to maintain traffic during the construction of the new bridge, a timber trestle was built parallel to the old structure and on its east side from Cliff avenue to the end of the swing span, and on its west side from the north end of the swing span down to the tide flats. The old draw span was then swung through adequate angle to meet these temporary trestles and traffic was maintained on this structure during the construction of the new bridge.

The structure was built by the city of Tacoma, of which Owen Woods is Commissioner of Public Works, and W. C. Raleigh is city engineer. The bridge was designed and its construction was supervised by Waddell & Harrington, consulting engineers, Kansas City, Missouri. The machinery and metal work for the superstructure was furnished by the American Bridge Co., and the International Contract Co. of Seattle were the contractors who constructed the substructure and erected the superstructure.

California State Roads

By S. J. VAN ORNUM*

IN 1910 the people of the state of California voted a bond issue of $18,000,000 for the construction of a system of state roads. A few states have voted larger amounts for the improvement of roads, as is the case in New York, which state has already expended $50,000,000 and has recently voted an additional $50,000,000. The bond issue of California, nevertheless, should be considered a progressive and constructive movement in supplying the fundamental basis of economical rural communication and transportation, and a factor of far-reaching importance in promoting the substantial development of the state.

The Highway Act provides for the improvement of "a continuous and connected state highway system running north and south through the state, traversing the Sacramento and San Joaquin valleys and along the Pacific coast by the most direct and practicable routes, connecting the county seats of the several counties through which it passes and joining the centres of population together with such branch roads as may be necessary to connect therewith the several county seats lying east and west of such state highway."

The extent of the undertaking can be better realized when one considers that approximately 2700 miles of highway must be constructed to conform with the requirements of the Highway Act.

The following general characteristics of the proposed road construction, adopted by the State Highway Commission, is described in an article in *Western Engineering* of September 1912 by Austin B. Fletcher.

1. A right-of-way at least 60 ft. in width.
2. Gradients not exceeding 7 per cent.
3. Open curves.

*Consulting Engineer, Pacific Bdg., San Francisco.

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

4. Proper drainage of surface and underground water.

5. A traveled way not less than 21 ft. wide where feasible, and in the mountains not less than 16 ft. in width, with the central portion paved in general to a width of 15 feet.

6. Smooth graded roadsides.

The construction of the state highways has been assigned to a commission of three, with the state highway engineer as their executive head. A large majority of the roads have been surveyed, and contracts have been let for 206 miles, consisting of the following types of construction:

	Miles.
Asphalt concrete (Topeka specifications)	12.7
Sheet asphalt	5.4
Bituminized concrete	142.1
Oil macadam	18.8
Macadam	7.6
Graded roads	20.1

The sections under contract for improvement with asphalt concrete are in Santa Clara and San Mateo counties, on the main road south from San Francisco, and in the majority of cases are at present improved with water-bound macadam. This macadam will form a foundation for a 1½-in. wearing surface by scarifying the old macadam, filling all depressions with sound rock, and thoroughly rolling it.

The 1½-in. asphalt concrete wearing surface is not an asphalt concrete in the true meaning of the word, as the specifications allow no stone that will not pass through a ½-in. screen and only allow a maximum of 10% of mineral aggregate passing a ½-in. screen and retained on a ¼-in. screen proportioned as follows:

	Per cent.
Bitumen	7½ to 10
Sand and stone-dust passing 10-mesh screen	44 to 78
Gravel or broken stone passing ¼-mesh screen	15 to 25
Gravel or broken stone passing ½-mesh screen	3 to 10

A true concrete must have sufficient stone or gravel or other coarse mate-

SECTION OF CALIFORNIA STATE HIGHWAY IN SAN MATEO COUNTY. CONCRETE BASE AND ASPHALT SURFACE.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

rial in its composition to form an important part, the coarse material being used in a large proportion, and the fine aggregate filling the spaces between the particles of coarse material. It can be readily seen that this requirement is not fulfilled in the above gradings of mineral aggregate. The true character of this mixture can be realized by reducing the average percentages to proportional parts, which gives:

One (1) part asphalt,
Six (6) parts fine sand,
Three (3) parts crushed rock passing a ½-in. screen.

If the proportional parts of sand and crushed rock were interchanged, the mixture would produce a most excellent asphalt concrete, but the mixture specified is simply a sheet asphalt in which is floating a small amount of coarser material. There is no intimate contact between the particles of crushed rock, hence the coarse aggregate does not increase the stability of the resulting pavement, and its permanency will depend entirely upon the scientific gradings of sand and the proper consistence and amount of asphalt.

Clifford Richardson, author and paving expert, commenting on this surface mixture, states: "The satisfactory nature of a mixture containing fine stone is no greater than that of the finer portion or mortar when the latter is looked at as an ordinary sheet asphalt surface."

An asphalt concrete pavement is a patented pavement which has been adjudicated in the United States Supreme Court and held valid. However, consent decrees have been handed down setting forth that a bituminous pavement having "no particles of stone that would not pass a screen with opening ½-in. diameter and that less than 10% of the stone or coarse sand used would be retained upon a screen with openings ¼-in. diameter, and the remaining mineral matter used being finer than ¼-in. diameter will not infringe the claims of said patent."†

A water-bound macadam road which has been in constant use for some time makes an excellent foundation for a hard-surface pavement, as it has withstood the test of traffic and any defects in the bearing power of the macadam or of the earth foundation would be manifest by depressions and a settlement of the road. These old macadam roads on the line of the state highway should be used as the foundation for a standard paving surface, thus saving the cost of constructing an expensive new base.

A portion of the state road in San Mateo county has been paved with a 1-in. sheet asphalt surface on a hydraulic cement concrete base. Cement concrete is the recognized type of base for sheet asphalt pavements, as it makes a permanent rigid foundation for the wearing surface. A 1-in. sheet asphalt wearing surface is, indeed, a questionable and doubtful innovation, and this thin surface laid directly on a concrete base with no binder to reinforce it should only be considered experimental.

The state roads, with the traffic concentrated on a narrow paved strip, will carry as heavy or heavier traffic than the majority of paved streets in cities, and this traffic will be more severe on the country roads, due to the fast-moving automobile and the heavily loaded automobile trucks. Therefore, the same requirements of substantial paving construction are essential for both state

†United States Circuit Court, Warren Brothers Co. *v.* City of Topeka, May 1910; United States Circuit Court, Warren Brothers Co. *v.* City of Creston, Iowa, June 1910.

Generated on 2024-09-30 00:21 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

highways and city street paving.

The specifications for sheet asphalt pavements of seventy-nine American cities recently adopted, provide for the following thickness of asphalt wearing surface and binder:

Cities.	Wearing surface.	Binder.	Total thickness.
15	2	1½	3½
29	2	1	3
8	1½	1½	3
15	1½	1	2½
1	2	½	2½
11	2	..	2

It will be seen from the above that the minimum thickness of asphalt wearing surface, when no binder is specified, is 2 in., and the minimum thickness of asphalt wearing surface is 1½ in. when constructed in connection with a binder from 1 to 1½-in. thickness which reinforces the wearing surface, gives it stability, and retards deterioration of the lower portion of the wearing surface from the effects of moisture. It is very doubtful whether it is economical to construct sheet asphalt pavements without the introduction of a binder between the base and the wearing surface, except under the most favorable conditions relative to traffic and moisture. Most paving engineers contend that the slight increase in cost of a sheet asphalt pavement with the binder course is more than counterbalanced by its increased life. Poor economy results by slightly decreasing the first cost of a sheet asphalt pavement, if by so doing the life of the pavement is thereby greatly decreased.

A 2-in. sheet asphalt wearing surface is sufficiently heavy to allow for a gradual decrease in thickness due to the action of traffic and to deterioration caused by moisture on the surface and from below for a long term of years, while, on the other hand, a 1-in. wearing surface is so thin that traffic will, within a short time, abrade and shift the surface, thus reducing its available thickness to such an extent that it will rapidly deteriorate and soon result in its entire failure. A thickness of 1 in., therefore, provides absolutely no factors of safety and wear as should be provided in all engineering construction.

Prior to, and at about the same period as the general adoption of the binder course in asphalt pavement construction, about twenty years ago, the laying of a 2-in. wearing surface directly on the concrete foundation was adopted in many cities on lightly traveled residential streets, and was known as 'light standard asphalt pavement.' A few years of practical use showed that these pavements cracked, deteriorated, and wore badly even under the lightest traffic conditions. Prior to that period, general specifications for asphalt pavement wearing surface consisted of two courses of a mixture of asphalt and sand. The lower course, ½ in. thick, called a 'cushion course,' being the same as the top course laid to a thickness of 2 in., except that the 'cushion course' contained slightly more asphalt cement than the top course. If, for any reason, even light traffic was allowed to pass over the 'cushion course' before the top course was laid, it would break up in the line of traffic in one or two days. Thus it was absolutely proved a quarter of a century ago that a ½-in. asphalt surface, even when laid unusually rich in bitumen, was not strong enough to sustain the weight of even light traffic.

Oil macadam, constructed by the penetration method, has been adopted on several sections of the state highway. Its construction consists of spreading heavy asphaltic oil in one

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

or more applications to bind the particles of rock together and prevent the rapid wear and raveling of the surface. Several years ago water-bound macadam was the standard construction for country roads, but with the advent of the automobile, with its swiftly moving rubber tires, the water-bound macadam became obsolete, as the motor vehicles had the effect of loosening and removing the finer particles of rock on the surface of the macadam to such an extent that the pavement would soon ravel and break up. Oil macadam roads have been constructed quite extensively in California, and experience in this class of construction has proved that it is most difficult to build a uniform oil macadam, as the process of spreading the rock and applying the oil in several courses cannot be sufficiently controlled to obtain that uniformity which is absolutely necessary for a satisfactory and lasting pavement. A deficiency of oil causes the surface of the oil macadam to ravel, while a surplus of oil produces a spongy and unstable pavement surface which will rut and creep under the action of traffic. The adhesive and cohesive property of road oil is slight in comparison with that of asphalt, due to the effect of the lubricating and light gravity oil contained in the road oil and the lack of these characteristics of road oil and the non-uniformity of construction must be overcome before oil macadam can be constructed successfully.

CONCRETE ROAD IN WEST SACRAMENTO, COVERED WITH ⅜ IN. BITUMEN. MARCH 29, 1913.

The pavement which has been adopted as the standard for state roads is termed bituminized concrete, and comprises a hydraulic cement concrete base having a minimum thickness of 4 in., overlaid with a paint coat composed of heavy asphaltic oil and sand or rock

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

screening. Over 75% of the contracts which have been awarded call for this class of road construction. Bituminized concrete is similar to Dolarway pavement, which was developed at Ann Arbor some four or five years ago, with the exception that, in the East, tar forms the basis of the paint coat instead of asphaltic oil. Although no patents have been granted for this class of paving construction, applications for patents have been made and are now pending. The general method of constructing bituminized concrete pavement, as provided for the state roads, comprises the construction on the prepared earth sub-grade of an ordinary cement-concrete paving-base 4 in. thick composed of 1 part of cement, 2½ parts of sand, and 5 parts of gravel or crushed rock. After this cement-concrete base has become sufficiently dry, it is thoroughly cleaned and coated with heavy asphaltic oil applied hot. The top dressing of sand or rock screenings is then spread over the oil, forming a carpet or thin wearing surface which is supposed to take the wear of the traffic and prevent any deterioration of the cement-concrete base. The advantages claimed for this pavement are its cheapness of construction, its economy of maintenance, and the permanency of its cement-concrete base.

BITUMEN-COATED CONCRETE. JERICHO TURNPIKE, SMITHSTOWN, COMMAC SECTION, LONG ISLAND. COMPLETED SPRING 1912. VIEW TAKEN DEC. 14, 1912.

Paint-coated concrete pavements are in an experimental stage, but experience in the East has demonstrated that the paint coat, when subjected to the abrasion and wear of traffic, requires constant repairs and frequent renewals. The writer has stated that the state roads will be subject to an ever-increasing traffic, and it has been demonstrated that a bituminous carpet en-

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

tirely fails when the traffic becomes heavy. Mr. Frank F. Rogers, deputy of the State Highway Department of Lansing, Michigan, in a paper entitled 'Repairing Cement Concrete Pavement,' states: "The pavement at Ann Arbor and Lansing was top dressed with tar and sand, refined tar being used on the latter work. This top dressing wears off annually, particularly in the central portion of the roadway, and has to be wholly or partly renewed at a cost of from 5 to 6 c. per square yard." * * * "It might be added that the tars are found to adhere to concrete better than asphalts."

The experience of the cities of Ann Arbor and Lansing with paint-coated concrete is universal wherever this class of pavement has been constructed, and the results in California will be more disappointing, as asphaltic oil, which does not adhere to concrete, will be used instead of tar in painting the concrete base. The constant repair and frequent renewals of the paint coat will be a tremendous annual expense, and, should means be provided to raise sufficient funds to maintain these roads, it is unquestionably bad policy and poor economy to spend annually such large sums on maintenance.

Should the paint coat fail to be constantly repaired and renewed after it breaks and wears off, the traffic will come in direct contact with the cement base, which is a solid, unyielding material which will fracture and abrade when subjected to the shock and vibration of continued blows of horses' shod hoofs and heavy loaded steel tires, but is recognized as a standard form of base for a permanent pavement when such base is overlaid with a durable wearing surface of sufficient thickness to absorb the shock and vibration.

The writer contends that in building our state roads the proper policy to pursue should be the construction of standard pavements, permanent in character, and eminently fitted to withstand the present and future traffic to which they will be subject without requiring the annual expenditure of large sums of money to properly maintain them.

Reinforced Concrete Oil Tank

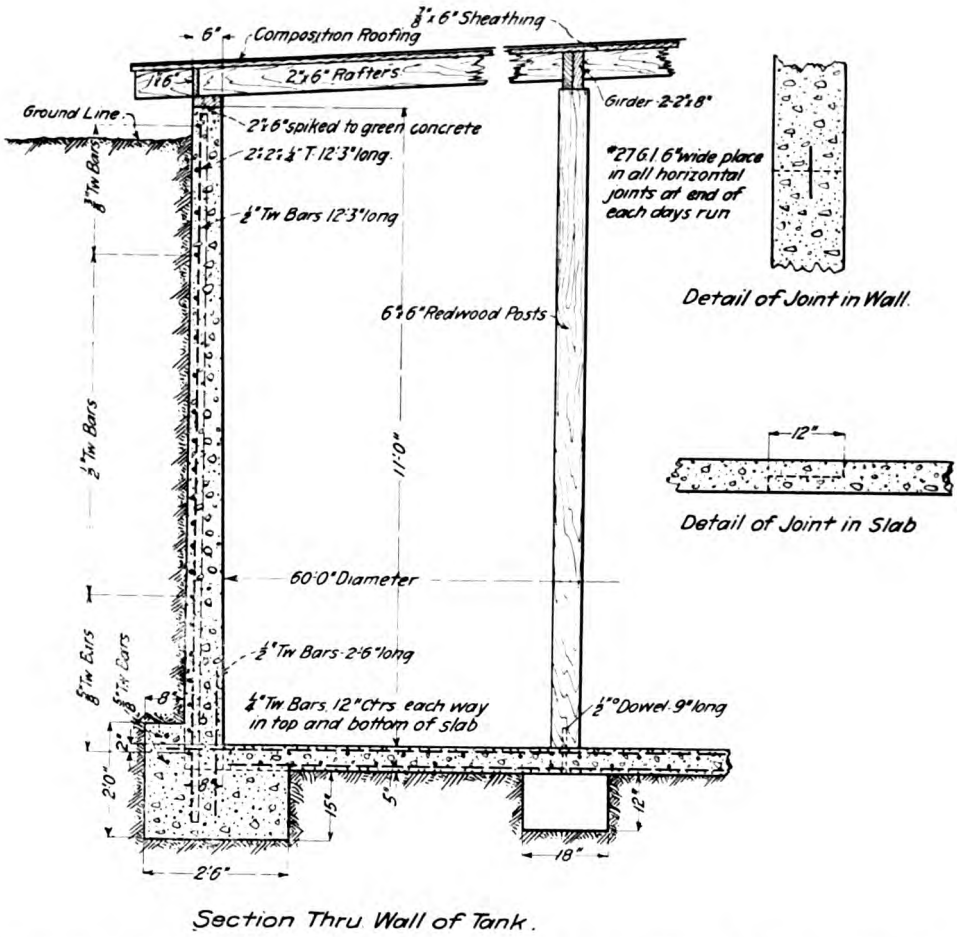
By EDWARD L. MAYBERRY*

THE use of concrete for the storage of water has been in vogue for many years, and with the introduction of reinforced concrete became still more popular from an economical standpoint. Reinforced concrete also permitted the use of circular reservoirs, the reinforcing steel taking care of the tensile stress in the circular shell. It became then only a problem of making the concrete impervious to water; that is, waterproof or water-tight, and this has been done successfully.

There have been many attempts with varying degrees of success of extend-

*Architectural Engineer, Los Angeles, California.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



REINFORCED CONCRETE OIL TANK FOR WEST ONTARIO FRUIT ASSOCIATION AT NAROD, CALIFORNIA.

ing the use of concrete, plain and reinforced, to the storage of oil. It has not been a question of cost, for the reinforced concrete reservoir, under normal condition, is more economical than the steel reservoir. It has not been a question of strength, for the reinforced concrete reservoir can be made equally as strong as the steel reservoir. It has been, however, a question of the action of the oil upon the concrete, involving, of course, the question as to whether concrete can be made impervious to oil.

It is a well known fact that even the heavy grades of crude oil will permeate where water would not, and, of course, the lighter grades of oil and distillate are still worse. The writer, however, knows of one instance in which the problem has been handled successfully.

The use of 'slop' distillate, as it is called, being a low grade of distillate, for smudging in the citrus belts, naturally brought up the question of the storage of an adequate supply to carry the orchards over a freeze. The West Ontario Citrus Association, at Narod, California, decided to use a re-

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

inforced concrete reservoir. This reservoir was built at Narod, California, and is 60 ft. in diameter and 11 ft. deep, giving a capacity of 235,000 gallons.

The accompanying cuts fully illustrate the details of construction. There only remains to describe the method of making the tank oilproof or oil-tight. This was done by adding an amount of hydrated lime equal to 10% of the cement to the concrete when it was being mixed. In addition to this, after the reservoir was completed, the entire inside, including floor and walls, was given a plaster coat from ⅜ to ½ in. thick, by the cement-gun, this being a process by which a sand and cement mortar is applied by compressed air. The reservoir has been filled with distillate and in use for over six months and there has been no evidence whatever of any seepage.

The reservoir was designed by Mayberry & Parker, architectural engineers, Los Angeles, and was built by L. Fleming, of Pomona.

Petroleum Products in Europe

By ROBERT P. SKINNER*

PARAFFIN is imported heavily into Germany from both the United States and Austria, requirements for which have increased substantially within the past five years, as the following statistics show:

Year.	Total imports. Tons.	From Austria. Tons.	From U. S. Tons.
1908	10,967	5832	3330
1909	15,105	8018	5262
1910	17,047	8405	6424
1911	16,504	7308	6678
1912	18,804	6060	9593

In the period named, while German needs have almost doubled, importations from Austria have declined and those from the United States have tripled. Galician producers appear to have been unable to deliver the quantities required, and the shortage from this source, as well as the general increase in business, has been made up by importations from the United States, Great Britain, British India, and the Dutch Indies.

Large quantities are also imported temporarily to be advanced in value, and reëxported without payment of duty. In 1912 the amount thus imported was 4186 tons, against 3334 tons in 1911. Present quotations upon Austrian paraffin are being made for prompt delivery, or until April 30, 1914. These prices are per 100 kilos (220 lb.) net, including double sacks, f.o.b. Hamburg, duty unpaid, transparent and opaque. Quantities and quotations follow:

	Melting point. °C.	°F.	Prices. Marks.	
45/48 and	48/50	118/122	41.75	$ 9.94
	50/52	122/126	44.25	10.53
	52/54	126/130	45.25	10.77
	54/56	130/133	48.25	11.48
	56/58	133/136	51.25	12.20

*Consul General, Hamburg, Germany.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

The Engineering Digest

Earnings and Investment in Transit Facilities*

By BION J. ARNOLD

AN analysis of growth shows that San Francisco is now growing faster than during the five years before the fire, and at a rate of increase of about 145,000 per decade. The real growth of the city, excluding the effect of the fire, has been at the rate of 54% for the last decade, as against 22% shown by the census. At the present time the city contains about 450,000 people. This population, on the conservative basis assumed, should double in 26 years, and should reach 1,000,000 people in 1945, although it may far exceed this.

San Francisco and the commuter district now has a population of 730,000 people, and has increased 48% in the last decade. This population should double in 23 years, reach 1,000,000 in 1919 and 2,000,000 in 1945.

In spite of this rapid growth, other large cities of the Pacific Coast are growing on the average at a rate probably 50% faster than San Francisco.

As a result of the fire, San Francisco lost 100,000 people permanently. The trans-bay cities gained in population by an amount practically equal to San Francisco's loss. But traffic statistics show that Oakland and its surrounding communities are becoming self-supporting to such an extent that the exodus from San Francisco has practically ceased, and that Oakland will go forward at a normal rate as a supplementary community.

One beneficial result of the fire was a general exodus of residents from the congested inner city to the suburbs, amounting to 66,000 people in the last census period. This has necessarily increased railway earnings and should therefore have made possible correspondingly improved service. The present distribution of population within the 30-minute zone is unusually uniform, except Chinatown and Japtown. The outlying distribution indicates that people will live where proper streets and car-service facilities are provided.

The growth and interchange of population within the district shows that the broader movements of population absolutely disregard municipal boundaries. The idea of a metropolitan district control for the development and regulation of utilities and industries is therefore of unusual necessity for San Francisco and the Bay cities.

A review of industrial growth shows that the period of great activity occurring just before the fire was practically recovered by 1910, and that commercial operations now generally exceed those of 1905. The fact that bank clearings suffered no perceptible depression during the disastrous year of the fire indicates the sustaining power of the financial credit of the community.

Manufacturing within the industrial district has alone failed to keep pace with the population within the last decade. In this respect the Bay cities have gained directly from San Francisco's heavy loss. The evident need for a more united industrial district points unmistakably to the practical value of the metropolitan district control idea already suggested.

An analysis of railway earnings shows that they are increasing in proportion to the square of the population; that is, when the population doubles, earnings quadruple. United Railroads earnings alone should double in the next 13½ years; that is, should

*From 'Report on Transportation Facilities, City of San Francisco'; conclusions and recommendations.

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

reach $16,000,000 by 1924-25 and should quadruple by 1942. Earnings per capita are now the highest in the country—$20 per capita for all companies.

In extension of track mileage, San Francisco is at least six years behind the necessities of the growth in population. Trackage should extend at least as fast as the population, if not faster. The total track mileage is now about the same as before the fire, due to abandonments, and the last 15 years shows a slower growth than at any period of the city's history.

The present necessities for track extension require about 15 miles per year up to 1920. This will be just sufficient to complete the extension schedule recommended, and is also required to catch up with the normal growth in population. From 1868 to the time of the Market Street Railway Co. consolidation in 1893, track mileage was extended at the rate of 8.1 miles per year, during the maximum period, 16 miles yer year. Since consolidation, the rate of growth has only averaged 3.6 miles per year.

The total operating equipment of all companies in 1911 was 676 cars. Prior to the fire there were many more cars reported, but of smaller capacity, averaging about 30 seats, as against 42 seats at the present time. Several hundred obsolete and worn-out cars were retired in 1907.

The total seating capacity at the present time appears to be about the same as before the fire, but it is a question whether the service capacity, in proportion to traffic, is as great in view of the increased schedule speed, owing to the exodus of population from the inner city to the outlying districts within the last census period.

Assuming the new equipment now on order by the United Railroads had been available to rectify the service requirements of 1911, the future growth of the city until 1920 will require an average addition of from 40 to 50 cars per year. This is a minimum schedule that can be carried out without materially diluting the net earning capacity, as San Francisco has already the highest earning rate from its equipment of any large city in the country. From 1889 to 1896, an average of 67 cars per year was added to the system, with maximum rates of increase within the period of from 140 to 200 per year.

The only way the above increase in equipment called for may be reduced is through the more efficient use of available car-miles by improved routing and by further increase in schedule speed. The size of the car units has about reached a maximum for the streets of this city.

That the extension schedule of track and cars called for here is not unreasonable is further indicated by the fact that out of the annual budget of investment predicted, about 25% will remain up to 1920 for betterments of existing property over and above the investment in new extension and equipment.

An analysis of the purchasing power of the city with respect to its utilities shows that the underlying property valuation is increasing at a slower rate than the necessary railway investment; that is, as the 1.7 power of the increase in population, instead of the square as in the case of earnings. At the very lowest estimate, $3 of capital must be invested for every $1 earned. Under the present bond limit, therefore, the city's ability to purchase or build is becoming more and more inadequate, thus requiring a progressive refunding basis.

The present available purchasing power of the city is approximately $51,000,000 for all purposes, including water supply. By 1930 the total railway investment required will be $62,000,000; by 1950, $123,000,000. This means that over one-third of the total bonding capacity of the city on its present 15% basis would be continually pre-empted for railway investment alone, assuming the city entirely free from debt.

If the city of San Francisco declines to accept the assistance of private capital in financing its utilities both for the present and the future, the conclusion cannot be evaded that a revision of the bond limit must be secured immediately in order to provide the capital necessary for preserving the normal rate of growth of the city as herein predicted.

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

Denatured Alcohol as a Decarbonizer and Engine Cleanser

By JOSEPH A. ANGLADA*

A SERIES of experiments has been recently concluded by me to ascertain the action af denatured alcohol in automobile engine cylinders in which there were carbon deposits. The following is a brief outline of the experiments conducted and the results obtained.

Completely denatured alcohol consists of ethyl alcohol (C_2H_6O) made undrinkable by the addition of other ingredients according to an approved Government formula, namely, 100 parts ethyl alcohol, 10 parts wood alcohol, and ½ part benzine. Alcohol denatured according to the approved formula is exempt from the usual Internal Revenue tax. It is produced under strict governmental supervision, which assures a uniform product. The average chemical composition of denatured alcohol is as follows:

Hydrogen, 12.68%.
Carbon, 47.08%.
Oxygen, 40.24%.

A quantity of denatured alcohol made according to the U. S. Internal Revenue Regulations and Instructions under the Act of June 7, 1906, and the Amendatory Act of March 2, 1907, was obtained. It was a colorless, mobile fluid with a peculiar spirituous odor and a sharp burning taste. Tests with litmus showed it to contain neither free acid nor alkali. When burned in an open receptacle it produced a flame which was slightly orange in color at the tips of the flame. The flame of undenatured ethyl alcohol when burned under the same conditions did not show the orange color at the tips; but the characteristic light-blue flame which we associate with burning alcohol. Both denatured and undenatured ethyl alcohol burned completely without smoke and without leaving a deposit in the receptacle.

The subject of cylinder incrustations or carbonization is, of course, closely related to the subjects of lubrication and carburetion and there seems to be a divergence of opinion as to whether most of the carbon found in the combustion space of cylinders is due to fuel or to the lubricating oil. It is often concluded that the carbon composing these deposits is derived from the lubricating oil, because of the solid nature of the deposits which sometimes appear slightly oily. It must be remembered that the surfaces of the combustion space generally are covered with an oil-film which forms an adhesive surface perfectly adapted to catch and hold whatever gasoline soot or other solid matter is brought into contact with them. It seems reasonable that a mass of oily carbon would be built up, if fresh oil and fresh carbon were being constantly supplied to these surfaces and that the heat of combustion would serve to consolidate these materials. Therefore, it does not seem necessary to assume that the lubricating oil is decomposed to account for the carbon incrustations in the engine which is using an over-rich mixture. It is, however, probable that the oil is also being decomposed; when one considers that generally in an engine which has run for some time, the under side of the piston head is coated with a carbon deposit. It might be well to mention here that a chemical analysis of so-called carbon deposit from the combustion space of an automobile engine, especially if this deposit has been formed during the summer months when the roads are dusty, will very likely show a percentage of silicates, which have been introduced in the form of road dust, held in suspension by the air passing through the carburetor. This dust upon coming in contact with the oily surface of the combustion space, lodges there and combines with the carbon deposited, whether from the decomposition of the lubricating oil or of the fuel, to form the incrustations. Some engineers claim that with the high-test oils now in general use, which do not give off combustible vapors below 400°F., there seems very little likelihood of any such action as the cracking or direct carbonization of oil upon the internal surface of a properly cooled motor. The exhaust valve and portions of the piston head may, however, be exceptions in the case of the engine, which is given to self-ignition, because in this case the oil upon the hottest surfaces may carbonize.

*1790 Broadway, New York.

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

An analysis of cylinder deposits will always reveal a trace of iron which undoubtedly comes from the rubbing surfaces of the piston and cylinder.

The presence of carbon deposits on the surface of the combustion space of any type of engine is to be avoided, because the radiation of heat to the outside surfaces of the cylinder is retarded. The presence of these deposits causes spontaneous ignition, which is a common source of rapid depreciation of the working parts of an engine, in addition to affecting its economical and quiet operation. Where the deposits are present in sufficient quantity, depending upon the design of the engine and the service in which it is employed, the operation of the engine may be entirely prevented, due to spontaneous ignition. The phenomenon of spontaneous ignition (sometimes called pre-ignition or self-ignition) is explained as follows: When the engine is in operation, the temperature of the gases in the combustion space during the period of combustion is sufficiently high to raise the temperature of the carbon deposit to a red heat. The result is that the deposit retains the heat imparted to it during the power stroke, and serves to ignite the new charge of inflammable gas on the following compression stroke. The result is that the ignition of the gas and consequent high explosive pressure occurs while the piston is on the upstroke, the effect being that the force of the explosion tends to suddenly stop the engine and reverse its direction of rotation. The inertia of the fly-wheel and momentum of the vehicle are generally sufficient to prevent this reversal, with the result that all of the power transmitting parts of the engine and vehicle are subjected to undue strains. The continuance of severe pre-ignition will in a short time cause the bearings of the connecting rod and generally the crank-shaft bearings to fail. In many cases, however, the connecting rod is broken by the abnormal strain put upon it, before the bearings fail. In high-compression engines it is possible for pre-ignition to occur due to an increase of compression, resulting from a decrease of compression volume because of a thick deposit of carbon, which may or may not be at a sufficiently high temperature to ignite the charge. Carbon deposits are frequently the source of loss of compression because of the flaky hard nature of these deposits, which will prevent the proper closure of the valves if a small part of the deposit is loosened and becomes lodged on the valve seat. Carbon deposits are the cause of greater wear of the working parts of the engine than appears at first thought. It is but necessary to filter the oil drawn from the crank case of a motor, which has been in operation but a short time and analyze and closely examine the substance extracted from the oil by the filter paper. It will be found that this substance is principally granular carbon which has worked past the piston rings and collected in the oil. This carbon is carried to all parts of the motor with the oil. The result is self-apparent.

Experiments were conducted during a period of about a month. The temperature during this period varied from 45° highest to 3°F. on the two coldest days. The engines of fourteen cars which had been in service from one to twenty months since being built or cleaned of cylinder deposits, were selected. In some of these engines the cylinder deposit was in the form of a coating of carbon, resembling lampblack, and could easily have been removed by wiping the combustion space with a cloth. It was not practical to do this, however, without disassembling the engines. Three engines had deposits which were baked hard on the combustion chamber surfaces and covering the layer of hard deposit there was a layer of the fluffy carbon, noted above. Two of the engines had deposits which were baked harder than in any of the other engines examined. The areas of these surfaces, which could be inspected through the valve plug holes, presented a slightly oily appearance. The appearance of the other deposits was a dead black. To remove the deposits which were baked on the surfaces would have necessitated the use of steel scrapers and finishing with coarse sandpaper in preference to emery cloth. Of course, it would have been necessary to disassemble the engines in order to properly remove the deposits; because none of the engines used in these experiments were fitted with removable cylinder-heads, though some had caged valves in the heads.

To test the cleansing properties of denatured alcohol, all of these engines were treated. The procedure follows in detail.

(*a*) The first experiment consisted of run-

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ning the motor of a 4-cylinder, 40-hp. car until the temperature of the cooling water was at 140°F. This motor has inlet valves on the side and exhaust valves in the cylinder heads. The exhaust valves are in removable cages. The cylinder cap over the inlet valve and the exhaust valve and cage of No. 1 cylinder were removed, and the engine turned by the crank until the piston in this cylinder reached top centre and the inlet valve was closed.

Examination showed that the combustion space, including the heads of the valves, was covered with a hard deposit nearly 1/16 in. thick. The exhaust passages in the exhaust valve cage were covered with a similar deposit which in spots was ⅛ in. thick. An attempt was made to remove the deposit by scraping parts of the surface with a piece of wood sharpened to a chisel edge. It was found impossible to dislodge any of the material, but a slight amount of fluffy material, similar to lampblack, was removed. When force was applied to the wooden scraper, its edge was broken without removing any of the caked deposit. It was found necessary to use a sharp steel instrument to effect the removal of any of the hard deposit. By applying sufficient force, lines could be scratched through the deposit, and in order to completely remove the deposit by this means, would have necessitated the disassembling of the valves and cylinders. To disassemble and then reassemble the valves and cylinders of this car has in the past taken the services of a mechanic and helper ten hours. To remove the deposit from the valves and combustion chamber by means of scrapers and emery cloth requires an additional four hours.

Continuing from the preceding paragraph, denatured alcohol was poured through the exhaust valve opening until the entire combustion space above the piston was filled. The openings in the cylinder for the exhaust valve cage and for the inlet valve plug were covered by cloths which had been wet with water, so as to retard the evaporation of the denatured alcohol, through these openings. The exhaust valve and cage and the inlet valve plug were completely immersed in a receptacle containing cold denatured alcohol and left to soak, in the garage with the engine. The average temperature in the garage for the eight hours during which the soaking occurred was 45° Farhenheit.

After eight hours, the inlet valve cap and the exhaust valve and cage were removed from the denatured alcohol. By means of a match stick, the deposit on the valve plug was removed as a black pasty mass, and then the surface was wiped clean with a few strokes of a piece of cotton waste which served to remove all of the deposit and leave the surface bright and clean as it was when the engine was new. The inlet valve plug was made of bronze. The exhaust valve and its cage were now inspected, and it was found possible to easily remove the deposit from these with a sharpened stick. The deposit came off in the form of flakes, some of which were ½ in. square. Some of the flakes were about as hard as mica and were slightly lustrous. Wiping the exhaust valve and its cage with cotton waste served to remove all trace of the deposit.

The head of the inlet valve which remained in the cylinder and the other parts of the combustion space which could be reached by inserting one's fingers, upon inspection disclosed that the deposit which eight hours previously had been hard and solid was now soft and flaky. No attempt was made to dislodge the deposit by mechanical means. The denatured alcohol was removed from the combustion space by means of an oil gun, the exhaust valve with its cage and the inlet valve plug were replaced, and the motor was started, and the compression cock of each cylinder opened.

Almost immediately upon starting the motor, bright red sparks coming through the compression cock of the cylinder which had been treated with denatured alcohol, were observed. By placing the hand over the compression cock of this cylinder, the bombardment of loosened deposit coming through the cock could be painfully felt by a series of sharp pricks similar to that of a needle. When a card was held over the cock, it promptly was covered by a number of small black specks.

After running the car in service about the city for eight hours, the exhaust valve with its cage and the inlet valve plug of the previously treated cylinder were removed. An inspection disclosed that the surfaces of the combustion space which had been covered with a deposit were now nearly entirely free from deposit.

The surfaces of the combustion space were now given a second application of denatured

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

alcohol, and the experiment of the previous day repeated, with the exception of not including a treatment of the exhaust valve and its cage and the inlet valve plug, which had been wiped clean after the first treatment. After the second application of denatured alcohol to the combustion space, and a subsequent running of the engine, the surface of the combustion space was as thoroughly freed from deposits as if it had been wiped clean, as noted above.

An inspection of the denatured alcohol removed from the cylinder after it had served twice as a decarbonizer, disclosed that the denatured alcohol had changed from colorless to light brown in color, and tests with litmus showed that it had not undergone a change in neutrality; that is, it did not show the presence of free acid or alkali.

(*b*) A 4-cylinder, 40-hp. car, the engine of which had recently been put in best running order, developed a marked decrease in power. An examination of the surfaces of the combustion space revealed a comparative absence of carbon deposits. As an experiment, 8 oz. of denatured alcohol was introduced into each cylinder while the motor was hot. After standing 8 hours, it was discovered that very nearly all of the denatured alcohol had leaked past the piston rings into the crank case, due to the poor fit of the pistons and rings caused by wear. Upon cranking the engine, it was found that the compression had almost entirely disappeared, and it was impossible to start the engine. A small amount of lubricating oil was introduced into each cylinder and the engine cranked vigorously. The compression was reëstablished and the engine started without difficulty. This experiment brought forth the fact that the introduction of denatured alcohol in the manner noted is an excellent way to determine whether the piston rings fit the cylinders properly. An examination of the oil in the crank case showed that it was unfit for use because it was diluted by the denatured alcohol which had leaked into it while the engine was standing idle. This oil was replaced by new oil and the car was then tested on the road. There was a marked increase in power, which the writer explains as follows: The loss of power was due to an unusual amount of friction between the piston and the cylinder walls, due to the use of a low grade of oil which gummed and did not permit the pistons to slide freely on the cylinder walls. The loss of compression was due to the alcohol dissolving the gummed oil, and the poor fit of the piston rings when the cylinder walls were not covered with a film of oil. The denatured alcohol dissolved the gummed oil and removed the source of friction.

(*c*) A 4-cylinder, 30-hp. car, the motor of which pre-ignited severely when the throttle was widely opened, was next experimented upon. The carbon deposit in this motor was unusually heavy, and the first application of 4 oz. of denatured alcohol to each cylinder and a subsequent period of rest over night failed to make an appreciable difference in the running of this motor. After five similar applications of denatured alcohol, the carbon deposit began to flake from the surfaces of the combustion space, and after a total of eight applications of denatured alcohol extending over a period of ten days, this motor was entirely free from the carbon deposits as far as the writer could determine by placing his fingers through the valve cup holes, and by visual observation. Pre-ignition ceased after five applications of denatured alcohol. Between each application of denatured alcohol the car was operated about six hours in regular service.

(*d*) A 6-cylinder, 60-hp. car was next experimented upon. The motor of this car was also badly carbonized. To remove the carbon deposit the valve cup in No. 1 cylinder was removed and the engine was revolved by the starting crank until the piston in this cylinder was at the top of the power stroke, when both valves were closed. The compression space was then filled with denatured alcohol while the motor was still hot, and the denatured alcohol was left to soak over night. This operation was performed on each of the six cylinders of this car. After two applications of denatured alcohol to each cylinder, this motor was freed of the carbon deposit. Between each application the car was operated about eight hours in regular service.

(*e*) A 4-cylinder, 20-hp. car, which had a slight deposit of carbon on some of the surfaces of the combustion space of the engine, was next experimented with by the introduction of 2 oz. of denatured alcohol into each cylinder through the compression cocks while the motor was hot. After the second application of alcohol, the flexibility and

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

power of the motor seemed to be increased as judged by the performance of the car on the road and the opinion of the owner of the car. Visual inspection showed that the deposit had disappeared.

(*f*) A 6-cylinder, 75-hp. car was next experimented upon. On two successive days, 4 oz. of denatured alcohol was introduced into each cylinder while the motor was hot. The carbon deposit in the cylinders of this car was of a fluffy nature and was not baked hard. The second application of alcohol served to remove all traces of this deposit. There was no apparent change in the flexibility or power of this motor after the use of denatured alcohol.

The preceding experiments were repeated on the engines of eight other cars, among which were included an air-cooled engine and an engine with all valves in cages situated in the cylinder heads.

In the cases where the valves were in cages, these cages with the valves were removed and left to soak in a bath of cold denatured alcohol for various periods. At no time was it necessary to soak these parts for longer than 12 hours before the carbon deposit upon these parts was loosened sufficiently to permit its ready removal with a scraper or cloth. In the majority of cases it was possible to remove the carbon deposit after a period of soaking of six hours by merely rubbing the part with a piece of rough cloth.

From the above experiments the conclusions I have drawn are as follows:

1. Denatured alcohol is an efficient decarbonizer for the automobile type of engine.

2. It does not injuriously affect the surfaces of the metals with which it comes in contact.

3. Heat is not necessary when using denatured alcohol as a decarbonizer.

4. Heat accelerates the action of denatured alcohol when used as a decarbonizer.

5. Denatured alcohol, when introduced in the combustion space of an automobile cylinder which is at the working temperature of the engine, will loosen the carbon deposit so as to permit the deposit to become separated from the walls of the combustion space and pass out of the cylinder with the exhaust gases when the engine is run.

6. The best results from the use of denatured alcohol as a carbon remover are obtained when the combustion space of a hot engine is entirely filled with liquid denatured alcohol and permitted to soak for a period of not less than six hours.

7. Denatured alcohol will act as a carbon remover when the engine is cold, provided the liquid denatured alcohol is in contact with the carbon-covered surfaces. The action of denatured alcohol under these conditions is about half as rapid as when the engine is hot.

8. The action of denatured alcohol as a carbon remover when introduced in small quantities into the combustion space of a cold automobile engine is positive but slow.

9. Where the fit between the piston rings and cylinder walls is imperfect, denatured alcohol will leak past the pistons into the crank case and cause the oil in the crank case to become unfit for use for lubricating the engine. However, when a sufficient amount of denatured alcohol has been added to this oil and circulated through the lubricating system of the motor for a very short period in order to obviate the possibility of damaging the wearing surfaces of the engine, denatured alcohol acts as a cleansing agent, as evidenced by the unusual amount of foreign matter withdrawn with the denatured alcohol-treated oil.

10. Due to the cleansing action of denatured alcohol as noted in the preceding conclusions, an engine which has been in service for an extensive period will show a marked increase in operating efficiency when thoroughly treated with denatured alcohol.

11. It is advisable to introduce, in the manner noted in the experiments, from 2 to 4 oz. of denatured alcohol (depending upon the size of the cylinders) into each cylinder of an automobile engine, at intervals of about three days, in order to keep the cylinders freed from carbon deposits.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

The Manufacture of Petroleum Products*

By F. C. ROBINSON

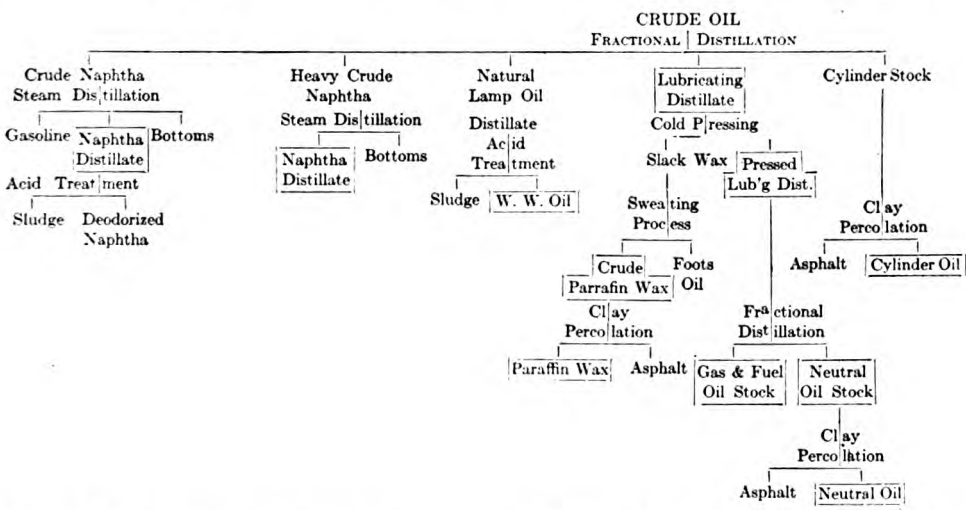
THE first group of products from petroleum is made up of gasolines and naphthas. There is some confusion among the various names, benzine, gasoline, naphtha, etc., but the best practice is to use the word gasoline for any mixture of light hydrocarbons intended for use in any kind of vaporizer; that is, to be gasified in a gas machine, gasoline torch, gasoline stove, or automobile carburetor. Also to confine the word naptha to mixtures of hydrocarbons intended for some purpose that requires a very good odor, such as the naphtha used by cleaners, varnish-makers, soap-makers, etc. In this scheme, the word benzine finds no place. Gasolines and naphthas vary in average boiling point according to the use for which they are intended, but all lie between 125 and 280°F. In all cases it is essential that they be free from all heavy hydrocarbons that do not evaporate from the hand.

The next group consists of several grades of lamp oil. Lamp oil is a mixture of hydrocarbons whose average boiling point is about 450°F., entirely freed on the one hand from gasoline or naphtha and on the other hand from the heavy hydrocarbons that belong to gas oil and lubricating oil and that would make the oil act badly in the lamp.

The next class is gas oil. While oils of all degrees of volatility have been used, the most economical for the gas-maker consists of a mixture of heavy hydrocarbons with an average boiling point of 600 to 650°F. It must be practically free from gasoline and lamp oil on the one hand, and from the heavy lubricating oils and asphalt on the other.

The next group is fuel oil. This oil occupies a peculiar position. It must be oil and must not contain gasoline and must be of such a consistence that it can be pumped through pipes and burners, but except for these restrictions one oil is practically as good as another for fuel. The light oils have a slightly higher heat of combustion per pound, but the heavier oils have a slightly higher heat of combustion per gallon. For some purposes, such as oil engines, special oils are required, but in general fuel oil is made up of oils that cannot be used for any better purpose.

The next group is that of spindle oils, neutral and paraffin oils. This important group includes hundreds of light lubricating oils designed for use on thousands of



*Abstract from *Proceedings* of the Engineers' Club of Philadelphia, April 1913.

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

different light machines, including gas-engines. They must be free from gasoline and lamp oil in order that their flash test shall be high enough to prevent loss by evaporation. The important point to that is that they shall have the proper viscosity for the use intended.

The next group is that of steam cylinder oils, which consist of the heaviest hydrocarbons contained in certain crude oils. In this case also the flash must be such that the oils will not evaporate in a steam cylinder and must have the proper viscosity for the use intended at the temperature of the cylinder.

The next group, paraffin wax, consists of a mixture of hydrocarbons of the paraffin series about $C_{29}H_{48}$ to $C_{35}H_{72}$. The commercial article is rated according to the melting point, which varies from 100 to 135°F.

The next group, vaseline or petrolatum, consists of the higher members of the paraffin series which settle from crude oil mixed and inseparable from some of the oily constituents of the crude. It is marketed as the light-colored material used in medicine and for toilet purposes or as the dark-colored sticky material used in large quantities by the makers of oiled paper.

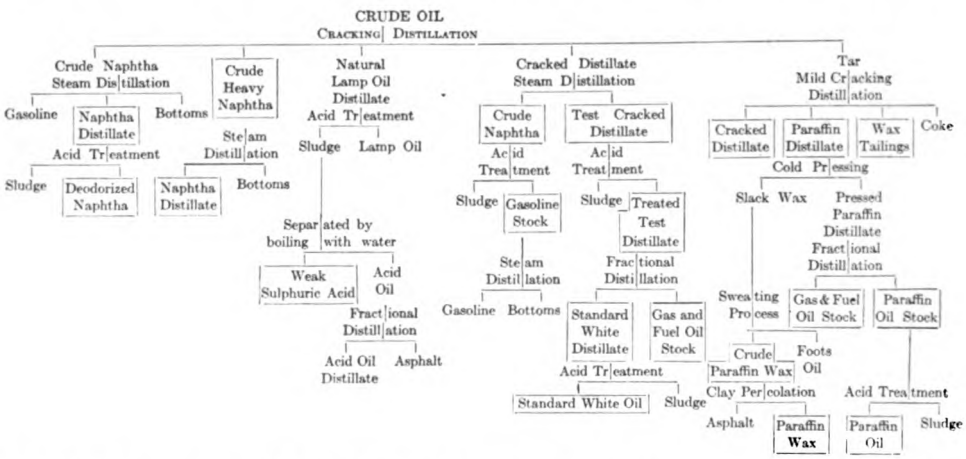
The next group, the dust-laying oils, consists of petroleum asphalt in solution in oils similar to gas oil. The basic idea in their manufacture is that the solvent will slowly evaporate, leaving the dust particles covered with a sticky adherent film. These oils have proved successful as a cheap means of laying dust.

The next group, the road binders, consists of petroleum asphalt properly fluxed with heavy petroleum oils that will not evaporate and of such qualities that they will bind the road materials together, both in summer and winter.

The next group, coke, contains but one member. This material being almost entirely free from ash, is used very extensively by makers of electric carbons.

These are the desired products. Now let us consider the crude oils from which they are obtained.

There are about as many varieties of crude oil as there are oilfields, but the refiner recognizes three distinct types, because each type must be handled by different methods: (1) the paraffin base crude, similar to that found in Pennsylvania and West Virginia, and being essentially light-colored crudes containing paraffin; (2) asphalt base crudes similar to those found in Texas and California, and being essentially black and containing no paraffin; (3) mixed base crudes similar to those found from Ohio to Oklahoma and being essentially mixtures of paraffin and asphalt base crudes.

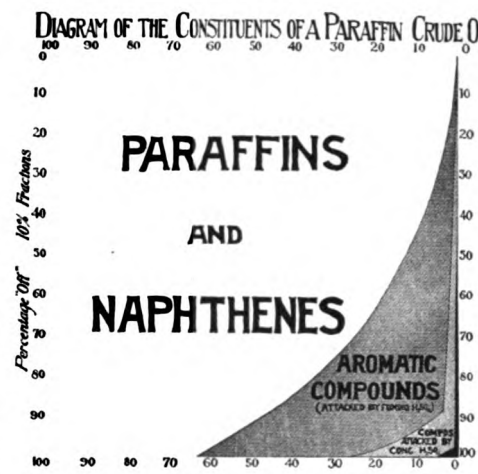


In order to obtain some idea of the chemical and physical nature of the crude oil, let us imagine a sample of mixed base crude brought into the laboratory for a thorough examination. The chemist would probably distill the sample in a vacuum or in some similar manner in order to avoid destructive distillation, and would save the various fractions separate. He would not distill off more than 90% because the heaviest 10% cannot be distilled without breaking it down into simpler molecules. He will then start

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

to examine the various fractions and will keep a record similar to the third chart. The horizontal lines indicate the ten fractions. The first fraction will be a light mobile mixture of hydrocarbons whose average boiling point is about 227°F. The second is a slightly darker and slightly less mobile mixture of hydrocarbons whose average boiling point is about 295°F. The third cut again darker, heavier, and less mobile, boiling point 369°F. The fourth cut still heavier and 460°F. boiling point. The fifth cut is about 530°F. boiling point. The remaining cuts are increasingly heavier, more viscous, and darker in color, and the residue in the still is a soft pitch. The chemist now asks what these ten fractions are chemically, and he recognizes four groups of compounds in each fraction that the refiner may have to isolate or remove. First the coloring matter indicated in the diagram by the black area. He can isolate this group by bone-black or fuller's earth. When isolated in a pure state, it is a jet black brittle compound which is very similar to the purest asphalt. A second important class of compounds is the material soluble in strong sulphuric acid. The low boiling members of this group represent the odor-bearing compounds of the crude, while the higher members are rich in sulphur and are easily oxidized. The refiner frequently has to remove a portion of this class. A third group is that of aromatic hydrocarbons, benzol, naphthalene, anthracene, etc., which may be removed by agitating the oil with fuming sulphuric acid. The remainder of the crude oil unattacked by fuming sulphuric acid is made up of the naphthene and paraffin series. It will be noticed that the amount of coloring is very small in the low boiling fractions, but very high in the high boiling fractions, and conversely that the amount of paraffins and naphthenes in the low boiling fractions is very large, while in the residue it is very small. Looking now at similar diagrams for a paraffin base crude and an asphalt base crude, it will be noticed first that the paraffin base crude contains very little, the asphalt base crude very much color or asphalt. Also that the paraffin base crude contains very much and the asphalt base crude very little paraffin and naphthene. Also that the paraffin base crude contains very little and the asphalt base crude very much of the aromatic group. Such information as these charts set forth enable the refiner to decide what products he can make and indicate in a general way the methods he must follow. For example, the charts would show: (1) the percentage of gasoline that the crude contains; (2) the percentage of lamp oil; (3) the percentage of lubricating oil, etc. However, you will please understand that this is not a practical assay of crude oil. It is merely an attempt to give you a chemical picture, so to speak, showing the distribution of the four important groups that the refiner has to deal with; also that each group consists of thousands of individual hydrocarbons that are never isolated even in the laboratory.

Now starting with crude oil, it is the task

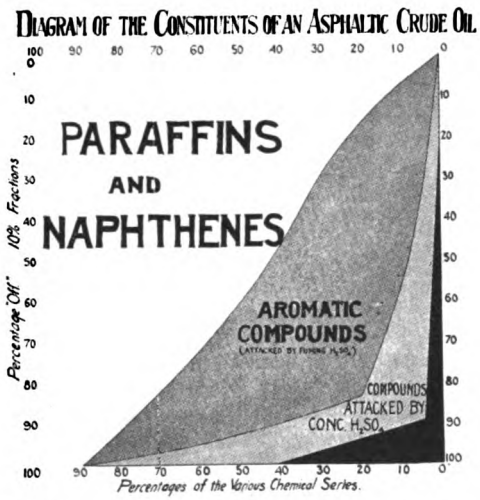


of the refiner to isolate the commercial products that have been shown. The processes are outlined on the two charts shown. They represent two distinctly different methods of refining, so much so that one refiner may decide to use one of them to the exclusion of the other, or he may decide to use both of them. He will be guided in this decision by his local conditions. If it be his desire to produce the maximum amount of gasoline and lamp oil, he will use the method marked 'Cracking Distillation.' If, on the other hand, he wishes to produce the maximum yield of the heavy lubricating oils and petroleum asphalts, he will use the method marked 'Fractional Distillations,' which means that he will simply separate from the crude oil the various fractions which compose it, while the refiner who uses the cracking process actually

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN

breaks down these heavy fractions by destructive distillation in a manner similar to the production of benzol and gas by the destructive distillation of coal.

The first step in the cracking process is the cracking distillation. The crude oil is pumped into stills containing 500 to 1000 bbl., which consist simply of horizontal steel cylinders made of sheets of ½-in. boiler-steel riveted together and provided with manholes on top and ends; with pipe for pumping oil into stills; with vapor line for conducting the distilled vapors to a condenser; with safety-valve; with combustion chamber underneath; with fractional air con-



densers and with water condenser; and with pipe for conducting away the gases involved during the distillation.

Such a still is nearly filled with mid-continent crude oil and fires are lighted. When the temperature of the oil in the still has reached 175 to 200°F., some gases, consisting largely of britane and pentane, are given off, and presently the highest naphtha starts to distill over. The firing is continued; the temperature in the still becomes gradually higher; the distillate becomes gradually heavier until the temperature in the still reaches about 325°F., at which point about 6 or 8% of crude naphtha (200°F. boiling point) has distilled over. This is set aside as crude naphtha. The distillation is continued until the temperature in the still has reached about 475°F. for crude heavy naphtha and represents 13 to 15% of the crude and has an average boiling point of about 300°F. The distillation is then continued until the temperature in the still has reached about 625°F. for natural lamp distillate, which represents about 16 to 18% and has an average boiling point of about 450°F. When the still has reached this temperature, cracking or destructive distillation sets in. The fires are slackened in order to distill very slowly, and this slow distillation is continued until the temperature in the still reaches 675 to 700°F., producing a distillate with an average boiling point of about 550°F., but containing some gasoline, some lamp oil, and much heavier oil which I have designated as gas and fuel oil stock. The yield of this oil is about 20%. It will be noticed that this cracking distillation is very different from an ordinary fractional distillation; heavy molecules have been broken down into lighter ones by submitting them to temperatures at which they are unstable.

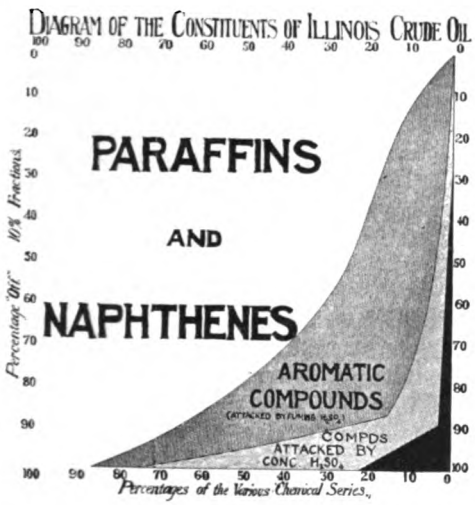
There yet remains in the still a heavy black tar representing about 42% of the crude oil. This is the source of paraffin wax and the line of lubricating oils called paraffin oils. It is no longer desirable to carry on a cracking distillation, because this would result in the destruction of the valuable products desired. The distillation is continued in such a way as to avoid cracking as much as possible (is distilled fast), either in the same still or more commonly in separate smaller stills called tar stills. This tar still distillation is carried on very rapidly in order to produce the maximum yield of paraffin distillate (about 22%). In addition to the paraffin distillate, there is also produced by destructive distillation about 15% of cracked distillate. At the end of the distillation the stream becomes so heavy that it will sink in water and is then known as wax tailing, which amounts to about 1% of the crude oil. When the distillation stops, there remains in the still nothing but coke, amounting to about 4% of the crude oil.

Now, taking up the various fractions; first the crude naphtha. This is again distilled; first in order to separate it into the various gasolines and naphthas that compose it and secondly to separate it from the small amount of bottoms or light lamp oil that it contains. This is done in a still which is heated by steam usually by injecting live steam directly into the gasoline. When the distillation starts, some gas is given off, then the lightest distillate ap-

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

pears at the trap usually about 90°B. gravity. The distillate gradually gets heavier until all the gasoline has distilled off. The receiver is then changed and the naphtha distillate is separated. At this point about 90% has distilled off, leaving a bottom about 10%. This bottom is essentially lamp oil and is used as such. The heavy crude naphtha is handled in the same manner, except that it contains little or no gasoline and contains about 50% of bottoms or lamp oil. The cracked distillate is also distilled with steam to remove about 4% of crude naphtha.

Up to this point all the operations have been different types of distillation. The next step in handling the naphtha distillate



from both sources, the lamp oil distillate and the crude naphtha from cracked distillate, and the test-cracked distillate is the acid treatment. It has been seen in the diagrams that all the fractions contain a certain percentage of material attackable by sulphuric acid so that this reagent affords a convenient means for removing color and odor from the remainder of the hydrocarbon distillate. In practice, the naphtha distillates are agitated with about 5% by volume, the lamp oil distillates with about 1.5% of sulphuric acid, oil of vitriol, for about a half-hour. The color and odor-bearing compounds combine with the acid, producing a heavy black viscous mass called acid sludge, which settles to the bottom of the vessel. The sludge is drawn off and the oil washed with water and alkali to remove all traces of acid, and is then ready for the market.

The sludge from all acid treatments is separated into unstable products. This is accomplished by boiling it with water, which results in the dilution of the acid and renders it incapable of holding in solution the impurities. The weak acid (30 to 50°B.) settles to the bottom, is drawn off, and reconcentrated. The upper layer consisting of the impurities is known as acid oil. This acid oil is separated by fractional distillation into a light distillate, which consists of all the evil odors that the original distillate contained and a residue consisting of the asphaltic compounds that were removed by the acid.

The next general subject is the handling of the paraffin distillate, which is the direct source of the paraffin wax and all of the paraffin oils. The first step is the process of cold pressing. The distillate is first cooled to 20 to 30°F. by pumping through pipes surrounded by cold brine, thereby causing the paraffin wax (amounting to about 10% of the distillate) to solidify. This solid 10%, mixed with the 90% liquid oil, forms a soft mush which is pumped through a filter press. That which stays in the press is called the slack wax, and amounts to about 20% of the paraffin distillate. The 80% that goes through is called pressed distillate. The slack wax, consisting of about equal parts of oil and wax, is then put through a process, peculiar to the oil business, known as the sweating process. It consists of cooling the mixture until it has become a solid cake and then very gradually warming it. The crystals of the paraffin form a network, through which the oil is distributed, and when the mass is warmed the oil sweats out and drifts away. It always carries with it some wax in solution, but the final result is that the oil all sweats out, leaving the paraffin wax in a fairly pure state.

This sweating process separates the slack wax into crude paraffin wax and what is known as foots oil. The latter still contains much paraffin, which is removed by putting it again through either the cold-pressing or sweating process.

The crude paraffin wax is then put through another process that is peculiar to the oil business, that of clay or bone-black percolation, for the purpose of removing asphaltic coloring matter and thereby changing the crude paraffin to refined colorless

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

paraffin. The clay used for this purpose has properties similar to those of bone black; that is, it absorbs and retains tarry and asphaltic compounds. It is found in Florida and Georgia, where it is mined, roasted, broken up, and sifted to separate grains such as seen here. It is very porous and light, weighing only about two-thirds as much as water. This clay, or fuller's earth as it is commonly called, is put into large upright cylinders holding 10 to 20 tons and provided with a finely perforated bottom. The crude wax is melted and poured on top of the clay. It trickles down through the clay bed and passes through the perforated bottom. The first drippings from such a filter-bed are absolutely colorless, but as the filtration progresses the color becomes more and more like crude wax. A ton of clay yields 5 or 6 tons of first quality paraffin wax. The amount of asphalt or coloring matter retained by the clay is exceedingly small and is removed by burning the clay in a cement kiln of the usual type, thus regenerating the clay for subsequent use.

I have explained that the paraffin distillate is the source of paraffin wax and light lubricating oils, and have explained the various steps in the preparation of paraffin. The light lubricating oils are made from the filtrate from the cold presses—the pressed paraffin distillate—by putting it through the process of fractional distillation, thereby separating it into distillate of light oils that go to make up the gas and fuel oil stock and a residue in the still called paraffin oil stock, representing from 15 to 50% of the charge of the still, depending on the quality desired.

This type of distillation is also peculiar to the oil business. The desired product is a heavy oil, so that all cracking must be avoided in order to produce the maximum yield of this oil. The result is accomplished by using the very important process of distillation with bottom steam or fractional distillation. A still is charged with the pressed paraffin distillate and fires are lighted. The temperature in the still rises, and when it has reached about 400°F. the distillation begins. Shortly after this the live steam is injected into the oil in distillation through perforated pipes placed near the bottom of the still. No water accumulates in the still because the temperature is so high. The steam passes upward through the oil as an inert gas and passes through the condenser with the oil vapors and is condensed there with the oil. The effect of this current of steam through the oil is exactly that of a vacuum distillation; that is, it lowers the boiling point of the oil in distillation and allows a heavy oil to be distilled at temperatures below the temperature of destructive distillation. It will be noticed that cracking sets in at about 630°F. Without the use of steam, the distillation in question would require that the still be heated to about 750°F. This would result in the destruction of the desired oil. With steam it can be carried on with a maximum temperature of 600°F., thus entirely avoiding destructive distillation.

The paraffin oil stock is a dark-colored, unattractive-looking material which is transformed into the valuable paraffin oils of commerce by treating with sulphuric acid in the manner already described. The treating loss in this case is from 10 to 30%. The whole cracking process described thus far is designed to produce the maximum yield of gasoline and lamp oil from crudes containing asphalt.

Klamath River Hydro-Electric Development*

By J. C. BOYLE†

THE hydro-electric development now under construction for the California-Oregon Power Co. is situated on the Klamath river, 13 miles east of the Southern Pacific railroad station, at Thrall, California. It is near the geographical centre of a 10,000-sq. mile territory in southern Oregon and northern California, in which the company now is distributing 20,000 hp., which eventually will be increased to 150,000.

*Abstract from *Engineering Record*, June 7, 1913.
†Thrall, California.

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

The engineering structures—dam, power-house, and forebay—are combined under the name of Klamath river dam No. 1. They are situated practically as a unit at the head of a canyon formed by the Klamath river eroding five distinct lava flows. Although the surrounding country is principally lava, and the walls of the canyon vary up to 250 ft. in height in lava, the river in its erosion has exposed at the site of the dam a reef, approximately 130 ft. high, across the canyon. This reef is of andesite, apparently continuous for a considerable distance on both sides of the canyon, and it is believed to be the oldest exposed formation in the country.

Geological conditions upstream from the side indicate that at one time the river ran over this reef, 130 ft. above its present bed. At that period the water was backed up about 5 miles and formed a natural lake, 1 mile in extent at its widest part.

It is now proposed to fill the gorge with a concrete dam and cover the old original lake bottom with an artificial body of water. This new lake will have a surface area of 1000 acres, a pondage of 77,000 acre-ft., and will be the third lake on the course of the Klamath river between its sources and the construction site. Two large Klamath lakes at present regulate the flow of the river, so that the high water at the dam never exceeds 6 ft. over the low-water stage, and the new lake will control the floods of the river to a still greater degree. It has been determined from gaugings taken near the site during a period of 1½ years that the maximum discharge in the river has been 4500 sec.-ft. and the minimum 1450 sec.-ft. Taking the average discharge for this period as 2000 sec.-ft., and allowing it to flow into the lake, it will take 20 days to fill the lake. For utilizing a portion of this pondage, allowance is being made for lowering the lake 2 ft., thus permitting 2000 acre-ft. to be used with the flow of the river during the low-water season or whenever a demand is made for it.

The dam will be of the arch-shaped gravity-section type, 130 ft. high above the river bed, 90 ft. thick at the base, and 13 ft. thick at the top. The length of the crest will be 400 ft., curved on the arc of a circle of 356-ft. radius. At the centre of the crest there will be a 200-ft. long spillway section, capable of discharging the biggest floods. At the back of the dam there will be a cut-off wall 10 ft. thick and at least 10 ft. deep. At the toe there will be an apron discharging the water in a horizontal direction.

Owing to the position of the canyon walls at the site, it was found impossible to place the structure straight across the river, the west abutment being farther downstream than the east abutment. However, by making the dam curved in plan to a 356-ft. radius, the ends were found to strike the canyon walls nearly perpendicularly.

The total yardage of the dam will be about 35,000 cu. yd., of which 40 to 50% will be laid in stone. To reinforce the dam at the bottom and on the upstream side, and to facilitate the handling of forms, 30-lb. rails will be embedded in the concrete. These will be spaced 4 ft. apart, placed 4 ft. from the face of the concrete, and laced together horizontally, both across and through the dam. The power-house will be of reinforced concrete, with a floor area of 70 by 170 ft., and will eventually contain four complete units, with exciters, switchboards, and transformers.

Each unit will consist of a 12,500-kva., 10,000-kw. at 80% power factor, 2300-volt generator, weighing 325,470 lb., connected to an 18,600-hp. cylindrical type hydraulic turbine of 84% efficiency, 20% speed rise, 200 r.p.m., weighing 400,000 lb., and governed by an Allis-Chalmers, oil-pressure type, flyball governor of 75,000 ft.-lb. capacity.

The penstocks, four in number, will be 125 ft. long and 17 ft. diameter and will be placed on a slope of 37½°. They will be made of steel plates ½ in. thick at the upper end and ¾ in. at the turbines. The water will have a velocity of about 5 ft. per second, depending on the load on the turbine.

The discharge from the turbine will be taken care of in a draft tube of concrete heavily reinforced at the top with beams. The area of this draft tube increases from 103.8 sq. ft. underneath the turbine to 535 sq. ft. at the wall of the power-house.

The exciter units will consist of two turbine-driven and one motor-driven exciters. The turbine-driven exciters will be of 200 kw., 250 volts, and the turbine will be of 300 hp., 720 r.p.m. of 83% efficiency, and will be connected with an oil-pressure type, flyball governor of 10,000 ft.-lb. capacity. These units

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

will be so connected that any one of them can be used on any of the main generators.

For each unit there will be three single-phase transformers, each of 4165 kva., 2300 volts capacity. The current from the generators will run through switches to these transformers and then out on a short transmission line 1½ miles in length to the central switching and transforming station at Fall creek.

The forebay will be the supply reservoir for the penstocks for the power-house. It is situated at the west end, adjoining the main dam, and extends 200 ft. around the canyon to a position directly above the power-house. Excavations have been made to a depth of 25 ft. below the ultimate crest of the dam, allowing 6000 sec.-ft. to enter the penstocks at a velocity of 5 ft. per second. An auxiliary spillway has been provided on the side of the forebay adjoining the dam for relief when the water in the forebay rises above normal and for taking care of any surge in the penstocks. A set of three gates will be provided for each penstock. These gates will be operated independently in sets, so that any unit can be shut down without affecting the others. Racks or screens will be provided, independent of the gates, of sufficient size to allow the passage of the water and to take out all floating material.

The outer wall of the forebay at the penstock side will be 10 ft. thick, 30 ft. high, and anchored at the bottom. The inner wall will be a reservoir wall of 6 in. thickness, with a batter of 1 on 10 and continuous with the floor. Both inner wall and floor will be reinforced. Ample floor and side drains will be provided to take care of any seepage through the concrete.

Two of the most interesting construction features of this installation are the diversion of the river from its channel while the foundations are being placed for the dam and the procuring and delivering of material for the installation.

The width of the canyon at the base of the dam is 70 ft., all of which is taken up by the water in the river. For 150 ft. above and 350 ft. below the dam the river channel has a grade of 2%, giving the water a velocity of about 20 ft. per second. The erosion of such a current would not permit winging the river from side to side, nor would blasting in the river bottom permit fluming it. Therefore a wing dam of rock-filled cribs 30 ft. high was made 100 ft. up-stream from the dam-site.

The wing dam diverts the river from its original channel through an unlined tunnel around the east end of the dam. This tunnel is 356 ft. long, with a cross-section of 16 by 18 ft. and a grade of 2 per cent.

Entering the tunnel, the water passes through three sets of headgates, designed for 110-ft. water pressure and large enough to carry the average flow of the river under a head of 10 ft. Each set of gates consists of a flap valve covering the entrance to a 6-ft. diameter pipe 30 ft. long with a butterfly valve, 6 ft. diameter, in the middle of the pipe, and a 12-in. by-pass to the chamber between the large valves for equalizing the pressure behind the flap valve. Each valve is operated directly and independently by a specially designed operating wheel on a platform above the crest of the dam. These three pipes are placed side by side horizontally in the direction of the tunnel and securely concreted together, thus forming a solid block.

In the delivery of materials, supplies, and equipment to the site a valuable acquisition has been made of a standard-gauge branch railroad which extends up the Klamath river from Thrall. By building an extension less than a mile in length from this railroad all the freight can be delivered directly from Thrall, 13 miles away, to the edge of the bluff overlooking the dam-site. The construction camp, warehouses, machine shop, cement house, etc., are at this end of the track.

The top of the bluff overlooking the dam-site is 100 ft. higher than the crest of the dam. The first 50 ft. of this height is taken up by a mixing plant, consisting of two sand machines, two rock crushers, and two mixers, all electrically operated. The output of this plant will be 720 cu. yd. of concrete per day of 9 hours.

A distance of 400 ft. back from the edge of the bluff is a cinder cone of a consistent quality of black volcanic cinder, which, after analyses and extensive tests, was found to be useful as a substitute for sand in the concrete. A gravity tramway to the edge of the bluff at the mixing plant will handle the cinder directly to the two sand machines, which will crush it to the required size and deposit it in a storage bin below.

The two crushers in the plant will crush

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

rock handled directly to them by a derrick from the quarry, discharging the broken stone into a storage bin beneath.

All cement used will be handled from the cars to the storage house or directly to the mixing plant, and, after passing a small storage bin, will be measured into the charging hoppers of the mixers.

The ingredients thus passing into the mixers by gravity are mixed at the rate of 40 cu. ft. per batch. The concrete is discharged from the mixers into open troughs, in which it travels by gravity across the canyon, or to any spot where it is to be placed. Remixers, boiling boxes, and branch troughs can be placed where needed.

A cableway with a traveling carrier has been provided for delivering the rock to be used as puddling stones in the concrete. The rock will be quarried from a lava bluff down-stream from the forebay but above it in elevation. That which goes into the dam as laid stone will be taken by gravity to the forebay level and handled with the carrier to any place in the dam, and the smaller rock quarried at the same time will be taken by the derrick directly to the rock crushers.

The headgates, wing dam, mixing plant, and smaller engineering structures have been completed, and in all probability concreting on the larger structures—dam, powerhouse, and forebay—will be started in the early summer of 1913. Upon completion of this installation the California-Oregon Power Co. will have added to its power developments a hydro-electric plant capable of producing 53,000 hp. This along with the available storage of peak loads within 1½ miles of the central switching station at Fall creek will make it one of the controlling plants of the company's extensive distributing system.

The work is under the supervision of Sydney Sprout, superintending engineer, and A. C. Sprout, constructing engineer.

High Flume Trestle in Idaho*

By A. M. KORSMO†

THE flume is a part of the Cottonwood Feeder Canal on the Twin Falls-Oakley irrigation project at Oakley, Idaho. The trestle forms the substructure for a corrugated-steel Lennon flume across a deep gulch. The material used in its construction was No. 1 common, rough Oregon fir lumber, which, considering its grade, was of good quality and fully dimensioned. In designing the trestle, a batter of 3 in 24 was used on the bent posts, this being considered sufficient on account of the sheltered location of the structure. The gulch is a very winding one and high winds never occur.

Structural Details.—The structure consists of a series of timber bents 23 ft. 6 in. on centres, every pair of bents forming a tower. All posts rest on concrete piers 1 ft. square on top, 18 in. high, and built with a batter of 1 to 2. Iron straps, anchored in the pedestals, are fastened to the posts to prevent sliding or overturning.

The trestle is 564 ft. long and has a maximum height of 96 ft. With the bents spaced 23 ft. 6 in. on centres it was considered impracticable to erect one deck at a time on account of the great amount of falsework and staging that would be required by this method. A cantilever erecting beam was then built, with the idea of erecting the structure from one end and completing each bent as the work advanced. The design of the erecting beam and of the framing of the trestle is shown in the accompanying drawing.

Erection Methods.—The north side of the gulch has a flat slope, the first four bents having no cripples; the erection was begun at that end. All cutting and framing was done below, in the bottom of the gulch, and 'snaked up' to place by mule-power, where it was assembled and erected.

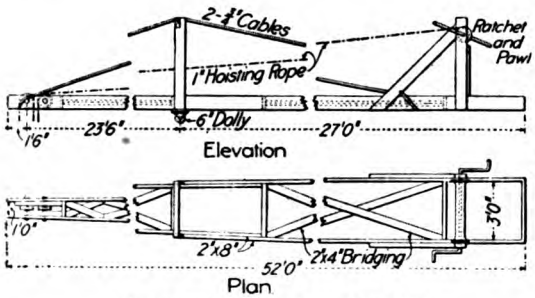
All the falsework required was a platform 4 ft. below the stringers, running back two bents from the one last erected. It was used to set the traveler on and as a scaffold from which the stringers and kneebraces were placed in position. As the traveler advanced, the falsework on the finished section was torn up, the 4 by 4-in. carriers of

*Abstract from *Engineering Record*, April 5, 1913.
†Construction Engineer, Faris Engineering & Construction Co., Oakley, Idaho.

Generated on 2024-09-30 00:21 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

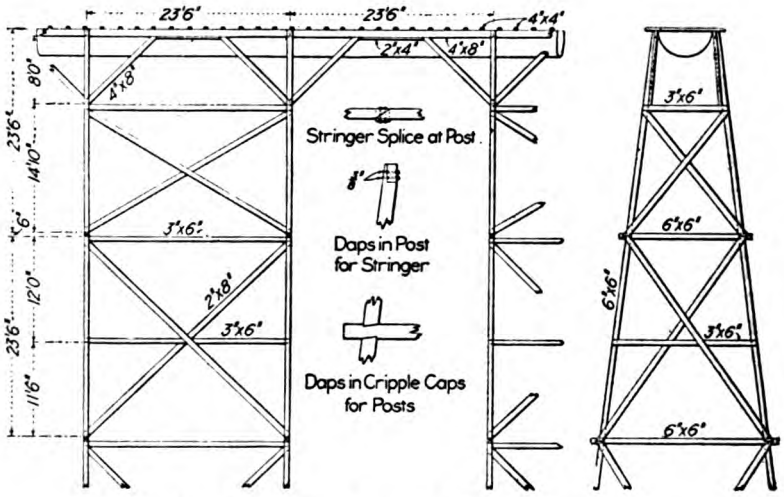
the flume were placed in position on the stringers, and the running planks laid on the carriers.

When the traveler had been rolled out into position by the aid of a dolly and the rear end of the traveler anchored with chains to the bent behind, the lower cripple of a new bent was ready to be erected. One end of the 3 by 6-in. running braces was fastened to the bent legs under the cap be-



DETAILS OF ERECTION TRAVELER.

fore the latter was erected. This was done with a ⅜-in. bolt, and when the bent had been hoisted into place, these 3 by 6-in. longitudinal braces were swung up into position and nailed under the correspond-



FRAMING DETAILS OF TIMBER TRESTLE IN IDAHO.

ing cap of the bent last erected. This was done by using tag lines lowered from the traveler platform above.

This method of erection was followed on all bents, and when the structure was completed all 3 by 6-in. running braces between towers were removed. When these braces were a part of a tower, the end which had been bolted was spiked and the bolts removed. Sway bracing was then raised and fastened in place by means of ropes and blocks, the latter being swung from the stringers above. Before the top section of a bent was raised, two 2 by 8-in. strips, one on either side of the bent and 4 ft. from the top end, were U-bolted to the posts. These carried the traveler platform, the erecting beam holding the bent fast until the stringers and staging had been placed in position.

Aligning Bents.—To help the workmen in getting up on the bents, to nail the cripple posts to the caps and fasten sway bracing, light ladders 21 ft. long were used. These had iron hooks at one end that encircled the cripple caps and were placed in position on each section before it was raised to place.

Care was taken to square each section of a bent before it was raised into place. However, to provide against any error due to a cripple cap not being centred directly over the one below it, the iron straps on the pedestals were set out 1½ in., which allowed for a shifting of the bents. Sights placed at either end of the trestle and the stringers were lined to them. As soon as all sections of a bent had been erected it was shifted into line before any tower bracing

Generated on 2024-09-30 00:23 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

was placed on it. No trouble was encountered from this source, as no bents had to be moved more than 1 in. to come into line. Fillers were then scabbed on the posts and all fastened together.

Erection Costs.—The erection covered a period of 15 days, with a crew of 7 laborers, 4 carpenters, and 1 foreman. Below is a record of costs. It should be noted that no experienced loft men were used. This was an important consideration, as it retarded the erection considerably, because the men were unaccustomed to work high in the air. With an experienced crew the erection would have cost at least $1.75 less per 1000 ft. board measure, this estimate being based on the subsequent erection of another, somewhat smaller, trestle by the same crew that built the high one.

SUMMARY OF COSTS

Laborers	775 hr. at 25c	$193.75
Carpenters	649 hr. at 35c	227.15
Foremen	148 hr. at 45c	66.60
Mule	150 hr. at 10c	15.00
Total		$502.50

Total lumber used equals 27.9 M. ft. board measure.

Average, $18 per M. ft. board measure.

The Faris Engineering & Construction Co., of Boise, Idaho, are the engineers and contractors on the work, and I, as construction engineer, had charge of the erection.

Electrolysis From Stray Electric Currents*

By ALBERT F. GANZ

EXPERIENCE shows that where there is serious trouble from electrolysis caused by large stray currents leaking from street railways, the bulk of this trouble is due to defective rail bonding, to ground connections from the negative bus-bar, and to lack of return feeders to bring current back from the rails to the power station. While stray currents can only be entirely eliminated by insulating the return circuit by the use of a double trolley, either overhead or in conduit, it is nevertheless a fact which is not generally appreciated that where large stray currents exist these can always be reduced to a small fraction of their present value by removing all ground connections of the negative bus-bar, and installing insulated return feeders proportioned for equal drop from radially disposed points in the track system at some distance from the power station. By this method the rails are drained of current and any desired part of the voltage drop can be removed from the rails and transferred to insulated conductors from which currents cannot leak. In Europe, such radial insulated return feeders for bringing current back from the rails to the power station are made necessary by regulations limiting the allowable drop in voltage in the rails, and in most cases such installations of insulated return feeders have substantially removed serious trouble from electrolysis. This system of minimizing stray currents by means of radially disposed insulated return feeders has also been installed in a number of American cities, and the method is gradually being recognized as by far the best for minimizing stray currents. This system in fact removes the root of the trouble, by draining the rails of current and removing voltage drop from the rails, and thus preventing substantial leakage of current through ground, and is therefore correct in principle. The railroad companies frequently object to this system, claiming that it is prohibitively expensive. This is certainly not the case, as is evidenced by the fact that the method is in general use in Europe and in a number of American cities today. The fact is that in many electric railways there is practically no installation of negative feeders and the railway companies are often not willing to install even a moderate amount of return-feeder copper. A mistake is often made in confusing the radial insulated return-feeder system with paralleling the rails with copper.

In the decree recently filed in the celebrated Peoria case, the railway company is enjoined and restrained from injuring the property of the water company by electric current escaping from the rails or structures

*Abstract from *The Wisconsin Engineer*, April 1913.

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

of the railway company. No particular method for preventing the escape of current is prescribed in the decree, because the court in its decision has already stated that a court does not have the power to prescribe by injunction any specific system, and that this power resides only with legislative bodies.

It is my firm conviction that such remedial measures as pipe drainage or insulating pipe joints should be used, if at all, only as a final measure, and never until the return circuit of the railway has been improved so that only small amounts of stray current remain on the underground structures. This view appears to be entirely in accord with the Peoria decision, and is certainly in accord with what may be considered to be without doubt the best engineering practice.

Cost of Hauling With Tractor Outfits on Illinois Road Construction

THE following data was abstracted from the fourth report of the Illinois Highway Commission on the cost of hauling road construction material.

DATA ON COST OF HAULING WITH TRACTOR OUTFIT AT HINSBORO, ILLINOIS. AVERAGE LENGTH OF HAUL, THREE MILES.

Number of cubic yards of stone hauled by engine	2,590
Number of cubic yards of stone hauled by team	3,980
Number of days outfit was on job	120
Number of days outfit hauled (fractions counted as full)	40

COSTS.

Cost to Illinois Highway Commission of engine operator (salary and expenses, straight time)	$340.00
Cost of fireman (actual time worked)	66.20
Coal, oil, and supplies for outfit	181.81
Cost of maintenance of hauling outfit (one-half season)	53.00
Total	$641.01
Total cost per cubic yard for hauling	$0.247
Total cost per cubic yard to township for hauling	0.096
Total cost per cubic yard to state for hauling	0.151
Actual cost per cubic yard for team hauling (on same work and same length haul)	0.560
Cost of hauling by engine per cubic yard mile	0.082
Cost of hauling by team per cubic yard mile	0.186

DETAILED COSTS OF ENGINE HAULING PER CUBIC YARD MILE.

Operator	$0.043
Fireman	0.008
Coal, oil, etc	0.024
Maintenance	0.007
Total	$0.082

DATA ON COST OF HAULING WITH TRACTOR OUTFIT AT MATTOON, ILLINOIS. AVERAGE LENGTH OF HAUL, ONE MILE.

Number cubic yards hauled by engine	674
Number cubic yards hauled by teams	2,170
Number days outfit was on job	22
Number days outfit hauled (fractions counted as full)	13½

COSTS.

Cost to Illinois Highway Commission for engine operator (salary and expenses, straight time)	$66.00
Cost of fireman (actual days worked)	27.00
Coal, oil, and supplies	51.00
Maintenance of outfit	26.00
Total	$170.00
Total cost per cubic yard for hauling	$0.258
Cost per cubic yard to township for hauling	0.115
Cost per cubic yard to state for hauling	0.143
Actual cost of team hauling on same work and same haul	0.435
Cost of hauling by engine per cubic yard mile	0.258
Cost of hauling by teams per cubic yard mile	$0.435

DETAILED COSTS OF ENGINE HAULING PER CUBIC YARD MILE.

Operator	$0.098
Fireman	0.042
Coal, oil, etc	0.077
Maintenance	0.041
Total	$0.258

Generated on 2024-09-30 00:20 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Company Reports

The Mount Whitney Power & Electric Co., for the month of May and the current year ended May 31, 1913, reports as follows:

	May. 1912.	May. 1913.
Gross earnings	$35,794	$47,872.42
Op. exp. and taxes	15,197	22,644.32
Net earnings	$20,597	$25,228.10
	Current year ended May 31.	
Gross earnings	$409,344	$479,359.93
Op. exp. and taxes	185,688	227,268.49
Net earnings	$223,656	$252,091.44

The Great Western Power Co. has reported for May as follows:

Gross operating income		$228,981.53
Operating expenses and taxes		71,917.34
Net operating income		$157,064.19
Other income		14,514.73
Net income from all sources		$171,578.92
Bond interest		95,108.34
Surplus for May 1913		$76,470.58
Surplus for May 1912		38,915.88
Increase of 1913 over 1912		$37,554.70

Holton Power Co. reports for the year ended December 31, 1912, as follows:

Surplus January 1, 1912		$16,627.74
Operating revenue	$174,258.76	
Operating expenses	97,457.28	
Net revenue		$76,801.48
Non-operating revenue:		
Rents		2,045.00
Gross income		$78,846.48
Deductions:		
Total		$47,412.65
Surplus for the year		$31,433.83
Deductions for year		207.55
Surplus for the year ended December 31, 1912		$47,854.02

Denver & Rio Grande Railroad Co.—During the year ended March 31, 1913, this company, operating in Colorado and Utah, had a record business, as follows:

Freight revenue	$14,072,406
Passenger revenue	3,953,775
Operating expenses	12,777,744
Net income, interest not deducted	5,351,426
Increase over 1911	1,216,658

The Coast Counties Light & Power Co. reports for the six months ended February 28, 1913, as follows:

	1913.
Gross earnings	$166,366.70
Operating expenses, maintenance, and taxes, including adjust. Un. trac. bal.	101,099.45
Total net interest available for bond interest	65,267.25
Bond interest	36,280.04
Surplus	28,987.21

Modesto Gas Light, Coal & Coke Co. reports for the year ended December 31, 1912, as follows:

Balance Jan. 1, 1912		$ 1,957.36
Operating income	$38,138.20	
Operating expenses	26,399.85	
Net revenue	$11,738.35	
Non-op. rev., gross inc.	$11,738.35	
Deductions	3,500.00	
Surplus for the year		8,238.35
Surplus Dec. 31, 1912		$ 10,195.71
Balance-sheet--Assets:		
Fixed capital—		
Plant, land, etc.	$66,198.51	
Equipment	74,299.01	
Miscellaneous	3,061.62	
Total		143,559.14
Miscellaneous assets		2,283.90
Grand total		$145,843.04
Liabilities:		
Common stock		$100,000.00
Loans and notes payable	$42,989.50	
Misc. accts. payable	1,521.52	
Total		44,511.02
Profit and loss cr.		1,332.02
Grand total		$145,843.04

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Book Reviews

WINDING ENGINES AND WINDING APPLIANCES. By George McCullough and T. Campbell Futers. Pp. 452. Ill., index. Longmans, Green & Co., London, 1913. For sale by the *Mining and Scientific Press*, San Francisco. Price $6.

The hoisting engine is one of the most important pieces of machinery about a mine, and is often the most uneconomical and least efficient portion of the whole equipment. While it must be granted that there are many causes which tend to make it impossible to operate a hoisting machine with the same efficiency as many other kinds of machinery, it, however, is possible by a careful and intelligent study of the duty and particular requirements of the various cases occurring in practice, to at least select that type of machine which is best adapted to the case under consideration, and will give the maximum economy and efficiency. It is the purpose of this book to treat the subject of hoisting engines as a whole, and with as simple mathematics as is possible, to direct the attention to the problems of design upon which their economy depends. The choice of system and comparison of the designs which are to be had is a most important subject, which is discussed in detail. Among the systems and designs covered by this volume are the duplex cylinder non-condensing engine with cylindrical drum and also the conical type drum with the same engines, non-condensing compound engines, high-speed engines with cylindro-conical drums, and other types. The principal results of investigations conducted with the various types of hoists are tabulated and presented in a manner which shows at a glance the variations that are to be expected in the operation of the different kinds of winding engines. Part II is devoted to the winding problems that arise in the working of deep orebodies where the ore has to be hoisted from depths of 3000 to 6000 feet. The advantages and disadvantages of the different systems used in this class of work are pointed out. The principal systems discussed under this head are the single-lift system, tandem system, and the two-stage system. The various considerations which enter into the choice of a hoisting machine for deep mines are explained in full, and the problems and calculations involved in deep hoisting are illustrated by examples. The relation between economy of first cost and economy of working are important, and the conditions are given which are to be considered in the selection of a particular type of hoist to meet the operating conditions. While there is but little or no difference in the calculations for hoists used in metalliferous and coal mines, the hoisting problem is simplified in coal mining, as the hoisting is done from but one depth, and the selection of a hoist will depend largely upon the tonnage to be handled. The problems as to rope, cylinder areas, horse-power, speed, and drum diameters are taken up and the methods given for arriving at the proper conclusions regarding these factors.

The subject of the application of electricity to hoisting is an important one. In modern practice, where available, electricity is becoming more generally used for hoisting purposes and a number of systems have been developed. There are three general systems of hoisting by electricity: first, where the current is taken directly from the generator or power-supply to the motor of the hoist; second, where the current is not taken directly to the motor but to a motor-generator, or what is commonly called a fly-wheel set or the Ilgner system; third, a system which is a combination of the first two by which the power mains are connected directly to the winding motor and also through transformers to a rotary converter. This system is known as the Westinghouse converter-equalizer system. The application of the various systems of hoisting, which come under these three general heads, forms an important part of the work, and the information and data contained in these pages are of particular interest and value.

The design of steam-engine details is given considerable attention. The subject of valve-gear is important, as it involves the economic use of steam and is one that is given little or no consideration by most writers on hoists. Cylinders, governors, main throttle-valves, cross-heads, pistons, and other parts are discussed as to their proper design and construction. The design of drums, brakes, and clutches is also an important subject, and is treated in a thorough manner. While there are so many devices designed with a view to preventing,

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

or at least minimizing, the consequences of the driver neglecting to shut off the steam at the proper point, that to describe them all would require a separate volume, this work does consider the more important safety devices under the heads of automatic engine-stops, slowing-down gear, and over-winding gear. The Karlik tachograph is also described with illustrations. This recording instrument for registering and controlling the work of the hoisting engine forms a valuable adjunct to the hoisting equipment. The work closes with a discussion of the details of the accessories of winding gear, including winding ropes; safety gear for cages and skips; cages, and methods of decking in coal mines; cage guides, head-gears, and other details.

RESUSCITATION. By Charles A. Lauffer. 47 pages. Illustrated. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*, San Francisco. Price, 40 cents, postpaid.

This little book is a presentation of the 'prone pressure' (or Shaefer) method of resuscitation from electric shock, traumatic shock, drowning, or asphyxiation. It is only by prompt application of artificial respiration that life may be saved, and in order to assure such promptness it is essential that the great mass of workmen and the public in general be trained in its principles. The prone pressure method is a one-man method, and requires no equipment other than the hands of the operator.

RAILROAD CONSTRUCTION. By Charles L. Crandall and Fred A. Barnes. P. 321. Ill., index. McGraw-Hill Book Co., New York. For sale by the *Mining and Scientific Press*, San Francisco. Price, $3.

This book is the successor to mimeograph notes prepared by the authors for the use of the civil engineering students at Cornell University. It is entirely descriptive and does not enter very deeply into discussion, and is exceptionally suitable for the young resident engineer who finds himself for the first time in responsible charge of work. The chapter headings are: Introductory, Earthwork, Rock Excavation, Tunneling, Masonry, Foundations, Culvert and Bridge Masonry, Trestle and Bridges, Track Materials and Roadbed, Estimates and Records.

Hints on Practice

Care of Air-Compressors*

It is a fact that air-compressors frequently pollute the mine air with dangerous gases, and sometimes explode, causing damage to persons and property. In either case, the same may be generally attributed to the excessive heating in the presence of compressed air of the oil and foreign substances that have collected in the cylinder, discharge pipes, and air passages, and especially in and around the valves. Volatilization and ignition of oil and other carbonaceous matter occurs very rapidly in the presence of highly heated air.

The greatest heating takes place where the air passes from the cylinder into the discharge pipe.

Even though the compressor is equipped with modern and approved cooling devices, insufficiency of size or too many angles in the discharge pipe, or incrustation of dust mixed with oil, at the discharge opening, decreasing the capacity of the discharge, any or all of them may produce enough heat to cause an explosion, or anyway produce dangerous gases which should not enter the mine. It is, therefore, important:

1. To keep the compressed air, while being compressed, at as low a temperature as possible.

2. To prevent oil and other carbonaceous substances from collecting in any part of the machine or in the discharge pipes.

All ports and air passages should be as large as practicable, and should be kept free from obstructions and incrustations. In addition to partly closing the ports, incrustation often causes the valves to stick, resulting in disastrous consequences.

To avoid incrustation and collecting of oil and foreign substances in the machine and discharge pipes, high-grade non-carbonizing oil may be used, and should be properly fed into the cylinder. Petroleum oil, especially free from volatile carbon, with flash point of not less than 625°F., is recommended. The oil should not be too dense nor contain animal or vegetable oil. Do not, in any case, use ordinary steam cylinder oil, because the heat in the steam cylinder is moist, and the surplus oil is washed out,

*Abstract from Safety Pamphlet No. 2, Alabama Operators' Association.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

whereas the heat in the compressor cylinder is dry, thus causing the oil to stick and cake. For the above reasons, and also on account of the difference in the character of the proper lubricant and the work it has to perform, the proper feeding of oil to the compressor cylinder is very different from the oil fed to a steam cylinder. Too much oil causes incrustation. A surprisingly small quantity of good oil will give sufficient lubrication to air-compressors. Watch your compressor and cut the amount of oil down to the minimum of its requirements. Oil should not be allowed to collect in the machine. In case it does, it should not be allowed to remain, but should be drawn off immediately.

Even when using the best oil, properly fed to the cylinder, the machine should be cleaned frequently, or when needed.

Do not use kerosene for cleaning. It is very dangerous. Kerosene has a flash point of about 120°F., and the temperature of the compressed air may at any time reach 300 to 450°F. and cause an explosion. The best and safest method of cleaning is to feed into the air cylinder, soapsuds made of one part soft soap to 15 parts clean water. Feed a liberal amount of this solution into the cylinder instead of the oil for a few hours, or even for a day, if necessary. The accumulation of this water and oil should be drained off from time to time during the process by opening the blow-off valve at the receiver.

To prevent rusting, it is necessary to run the machine and feed oil into the cylinder for an hour or so after the cleaning process is completed and the water drained off, so that the valves and all parts connected with the cylinder will become coated with oil before shutting down the machine.

The temperature of the discharged air should never exceed 250°F. The machine should be watched, and if the temperature exceeds the above, it should be shut down and cooled. If possible, the cause of overheating should be eliminated before starting up again.

The temperature increases as the pressure increases; therefore it would be well to equip all air-compressors with an automatic pressure or temperature regulator, which will allow the compressor to run idle as soon as the pressure or temperature in the receiver reaches a predetermined limit and likewise bring the compressor into action again as soon as the pressure or temperature falls below this limit.

As an extra precaution, a fusible plug may be placed in the discharge pipe near the compressor. This plug should be made to fuse and blow out at a temperature of between 325 and 350°F. Proper construction, proper care of the machine, high-grade lubricants, may save life, and are cheaper than shutdowns, lost power, property destroyed and damage suits.

FOR SOLDER, chloride of zinc is the best ordinary flux for general purposes. It should, however, be free from any excess of acid, and is made by dissolving zinc in muriatic (hydrochloric acid) until there is no more action. An excess of zinc should always be used, so that when the action of the acid ceases there is some zinc left. A neutral solution of chloride of zinc is thus obtained.

THE FOLLOWING ALLOY is claimed to possess exeeptional qualities with regard to its ability to resist the action of acids: nickel, 66.6%; chromium, 18; copper, 8.5; tungsten, 3.3; aluminum, 2; manganese, 1; titanium, 0.2; boron, 0.2; and lithium, 0.2%. This alloy is difficult to cast, because it contracts considerably at the point of solidification. It can, however, be drawn into wire, and is easy to work.

Engineers' Note Book

Water-Pressure on Cylindrical Surfaces*

The use of rolling dams is quite common in Europe, and is now under consideration for a number of power projects in the United States. For determining the pressure on the horizontal cylinder, the so-called 'normal theory' has been used, despite the fact that the results were known to be inexact. The method described herein has been used by E. Jacoby, of Riga, Russia, and was presented recently in an article by him in the *Oesterreichische Wochenschrift für den Oeffentlichen Baudienst*, from which the following notes are taken. The method is, of course, equally applicable to pressures

*Abstract from *Engineering Record*, March 8, 1913.

Generated on 2024-09-30 00:22 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

on any horizontal cylindrical surface.

Fig. 1 shows a partial cross-section of a horizontal cylinder with X and Y axes through the centre. If the water surface is at a distance h below the X-axis, the normal water-pressure on a unit area of the surface is

$$dp = \gamma\,(y - h)\,da$$

where γ is the specific weight of water, or 62.5 lb. per cubic foot, p the pressure, and da the unit area. If the calculation is carried out for a strip of unit width of the cylinder, then $da = 1 \times ds$.

The element ds has two components, dx and dy, parallel to the X and Y axes, respectively, and these give the horizontal component of the water-pressure as

$$dH = \gamma\,(y - h)\,dy \qquad (1)$$

The vertical component is

$$dV = \gamma\,(y - h)\,dx \qquad (2)$$

Equation (1) indicates that the horizontal component increases in proportion with the depth of water. When $y = h$ (that is, at the water surface) $H = o$, and when $y = r$ (that is, at the bottom of the cylinder) H is a maximum. The horizontal pressure can therefore be indicated by an isosceles triangle CDE, in which the height and the base are each equal to $(y - h)$. This means that the horizontal component of the water-pressure equals the pressure on the vertical projection of the wetted surface of the cylinder. If, therefore, an area of unit width and a length ab is located between the ordinates y_1 and y_2, the horizontal water-pressure is indicated by the trapezoid $GHIK$, and the point of application is naturally in the centre of gravity of the figure.

In calculating the vertical component, y must first be expressed in terms of x, and this is readily done by means of the relation

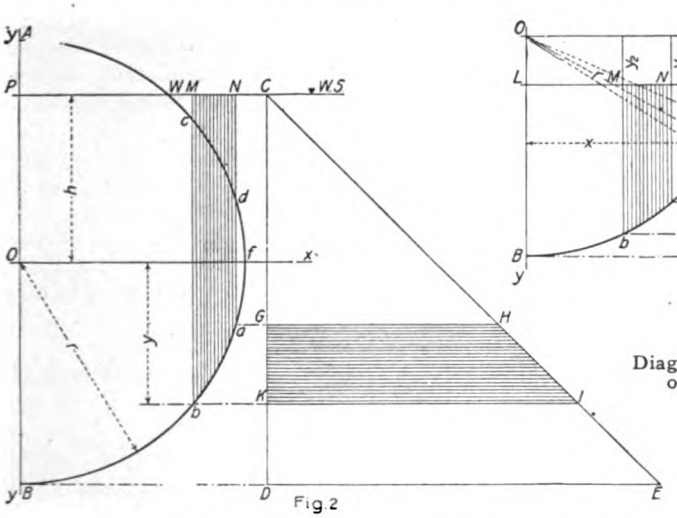
$$y = \sqrt{r^2 - x^2}$$

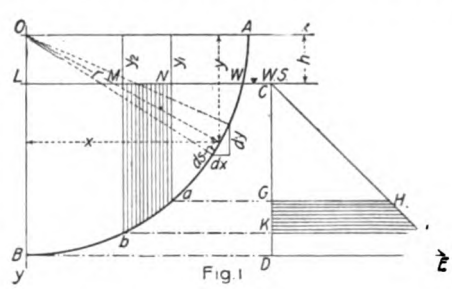
Replacing y in equation (2) with this expression, we have

$$dV = \gamma\,(\sqrt{r^2 - x^2} - h)\,dx$$

Since $y = \sqrt{r^2 - x^2}$ is the equation of the circle it is clear that the total upward pressure is indicated by the area between the arc BW and the water-line WL. Therefore, the vertical water-pressure on ab is shown by the figure $abNM$, of which it is comparatively easy to find both the area and the centre of gravity. It is also evident that the vertical component is nothing else but the uplifting force of the water and is equal to the displacement multiplied by γ.

Should the water-surface be at a distance h above the X-axis, the horizontal component would, as before, be illustrated by the isosceles triangle CDE, in which the height and base are each equal to $(y + h)\,\gamma$, and the vertical uplift by the figure $BbafdcWP$. If only the part ab of the unit width is taken, the horizontal component is shown by the trapezoid $GHIK$, and the vertical by the area $abNM$. On the part cd there is a downward vertical load equal to the weight of the water and its value is given of the area $cdNM$.





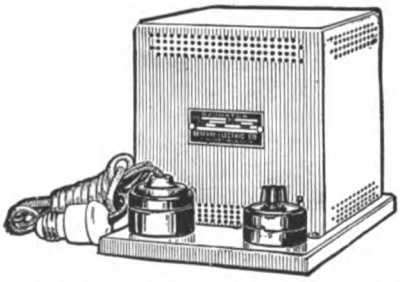
Diagrams of Water Pressure on Cylindrical Surfaces

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Industrial Progress

Ozone and Its Applications *

Sanitary ventilation is a complex problem. Oxygen must be supplied to replace that consumed, and the by-products of this consumption must be carried off. This may be an easy matter, but this in itself is not sufficient. A room may contain sufficient oxygen, have the proper degree of temperature, and yet be unbearably stuffy, close, or have an unpleasant odor. This condition is dangerous to health and reduces human efficiency. Nerve centres are affected, producing tendencies to nausea, headache, lassitude, and the impairment of normal functions. There may be plenty of so-called fresh air, but the air is dead. Those who breathe it feel lifeless also, and as a consequence their minds and bodies do not work to good advantage.



ALTERNATING CURRENT UTILITY OZONATOR.

Supply all the air permissible, exhaust all the bad air possible from a room, but an ideal result cannot be obtained unless the organic matter exhaled from the lungs and bronchial passages by the occupants of the room is destroyed. Forced draughts only partly achieve the desired result. Theoretically, it should suffice to supply an amount of oxygen per hour equal to that consumed per hour in given space. In practice this is far from sufficient, as an excess of air is required to mechanically remove 'smelliness.'

The harmful impurities in the air are largely due to decaying or decayed organic matter, and such decayed matter is the natural food for bacteria. Its elimination, therefore, would materially decrease the bacteria contents of air by producing a condition unfavorable for their existence and multiplication. Since the mechanical movement of air is but an incomplete remedy for bad air trouble, some other agent must be employed to obtain the desired result.

Scientists have shown, after many years of research and experiments, that ozone, properly applied, will purify air, destroy organic matter and odors, and check the growth of bacteria.

Ozone is not a new subject, though its application is comparatively recent. The first recorded mention of ozone was by Van Marum, who in 1785 observed that oxygen through which an electric discharge had taken place was possessed of a peculiar odor, somewhat resembling that of chlorine. Van Marum referred to this as the "smell of electricity." The same smell was subsequently referred to by other observers, but it is not on record that efforts were made to analyze or classify the phenomenon chemically or physically.

In 1801 Cruickshank, during some of his experiments on the electrolysis of acidulated water, observed what he has referred to as the "same smell of electricity as that observed by Van Marum," and he concluded, after further investigation, that electricity was liberated with the oxygen in water—electrolysis.

To Schoenbein is due the credit of having first recognized and studied ozone. In 1840 he prosecuted a very exhaustive and fruitful research upon the action of static condenser discharges, and established the fact that the observed odor was due to the formation of a new gas, and invented the name 'ozone' from the Greek word which signifies smell.

The common method of ozone production for commercial purposes is by the action of the electrostatic field on air or oxygen. Ozone is a gas whose molecule consists of 3 oxygen atoms. It is a much more active substance than ordinary O_2, having a much greater oxidizing power, especially at low temperatures, being one of the most powerful oxidizing agents known, and is rapidly demonstrating the fact that it is of inestimable value as an air purifying agent. This is shown by the fact that it quickly consumes itself on organic matter and other impurities, its action being rapid and certain.

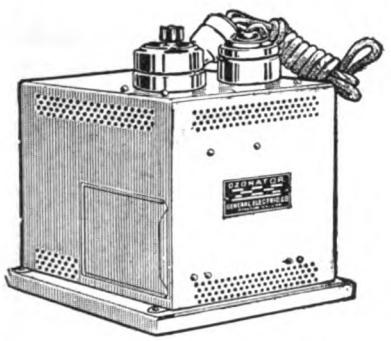
Ozone is produced naturally by the pine trees, which give off certain oils that cause a chemical reaction with the oxygen in the

*From data furnished by Pacific States Electric Co., San Francisco, California.

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

air. Electrical disturbances in the air also produce ozone. These are the only natural methods for producing ozone which are commonly understood, though it is assumed that it is produced in other ways. It is claimed that in some unexplained manner, the action of the sun and tides on long stretches of sandy shore produces ozone.

It is detected very frequently on high mountain tops, around the seashore, and on the sea. In both instances it is detected because there is no organic matter or impurities on which it can consume itself, and the very presence of ozone indicates that the air is pure.



DIRECT CURRENT UTILITY OZONATOR.

The application of ozone to the purification of the air we breathe opens up a wider and more important field than any heretofore undertaken. The sterilization of water by means of ozone is a very important process, but pure water usually can be obtained without sterilization. Human beings must have air, but they never know when it is carrying dangerous poisons or infectious bacteria.

The chemical instability of ozone in the presence of any organic matter and its reduction of poisonous gases to more stable and less harmful compounds make it the most logical air purifier. In air purification by ozone, there can be no question raised as to its thorough diffusion and intimate contact with the air content. It diffuses rapidly through any air spaces and is immediately brought into intimate contact with whatever the air contains.

The air of poorly ventilated rooms is altered as follows: There is a slight decrease of oxygen followed by a corresponding increase in carbon dioxide, organic pollution and moisture. A rise in temperature causes the expired air to rise. There are many solid particles, including animal débris and bacteria suspended in the expired air.

The poisons in the air, due to the presence of relatively too many people for the air supply, induce a lowering of the vital process, loss of muscular strength, and impairment of the nutrition. Aeration of the blood is diminished and it becomes loaded with waste products. Victims naturally crave stimulants and become less resistant to the onslaught of disease germs. The amount of carbon dioxide is interesting only as an indication of how much respiration the air has undergone, thus acting as an index of the organic poisons present. The real poisons are products of animal metabolism and, therefore, organic and oxidizable. Ozone combines with them and changes them to ash and water, for instance, to stable oxides which are inert and harmless. By purifying the air with ozone, the quantity of new air required is decreased and the cost of ventilation and heating is lowered.

Odors are eliminated in a measure impossible by ventilation alone. By far the greatest benefit of ozone ventilation is the sterilization of air. The pure refreshing and invigorating smell of ozone in small quantities is pleasant and is enjoyed by everyone who knows that ozone indicates purity. Even the slightest trace is an indication that all harmful impurities have been removed from the air.

Ozonized air can be breathed very comfortably by most people in concentrations of 3 to 6 parts in a million, but some people who might be affected by high altitudes or have a nervous system which responds very rapidly to stimulation, find such concentration objectionable.

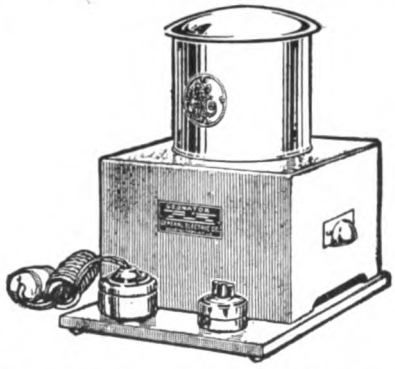
The usual practice is to recommend concentrations of one part in a million or slightly less. In such a concentration, the odor is not at all objectionable and gives a very delightful tang to the atmosphere, not unlike that obtained in the pine forest.

The general introduction of ozone for purposes of sanitation has gained a strong foothold in Europe, and during the last three years has attracted considerable attention in America. Three of the most important installations abroad are: the German Parliament house, which uses over 7,000,000 cu. ft. of ozonized air per hour, the Town Hall of Amsterdam, and the Cen-

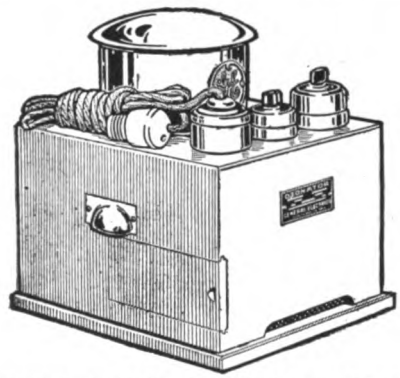
Generated on 2024-09-30 00:20 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

tral underground tube. Other important installations are: the ice skating rink at Berlin, the playing hall at Monte Carlo, the London-Lloyds Maritime Exchange, the Royal Exchange, His Majesty's Theatre, the Royal Court of Justice, and practically all of the large hotels, theatres, and slaughter houses. Among the more important work in this country are the national capitol buildings at Washington, the New York Tribune building, the Hudson river tubes, and the Hudson Terminal building.

In the application of ozone to the industrial arts, there are numberless processes of manufacture wherein oxidation plays a prominent part. Wherever oxidation is desired, ozone is a logical adjunct to the process and is being so used, although in a number of instances, the processes are secret. The processes usually require ozone in much higher concentration than is permissible in the application to the purposes of sanitation.



ALTERNATING CURRENT HOUSEHOLD OZONATOR.



DIRECT CURRENT HOUSEHOLD OZONATOR.

The fundamental principle of ozone action makes it possible to use it in the preservation of food. Experiments have shown that milk and other dairy products can be completely sterilized and kept from souring for a long time. Eggs stored in ozonized air keep for months with no apparent change, and the effect on fruit is striking, as ozone prevents the molding which starts on the outside of the skin.

Refrigeration engineers have found that ozone adds greatly to the value of plants for storing meat products and that the temperature of the refrigerating room or chamber can be considerably higher in the presence of ozonized air than under ordinary conditions. As a preservative, ozone is destined to meet with considerable use, supplanting in degree the use of drugs, sugar, and sterilization by heat. Considerable success has been secured by the installation of ozonators to prevent the growth of parasites in the storage of flour and flour products. It has been applied in many breweries in England and Belgium, where its use in cellars prevents parasitic growths and has no unpleasant effect on the fermenting process. The number of bacteria in cellars thus equipped is greatly reduced, and it is generally found that those which are not directly killed are not capable of reproduction.

In France, manufacturers of wines and liquors have found that the use of ozone destroys the unpleasant odor and tends to oxidize the fusel oil in products which have not been sufficiently aged. In this way, manufacturers have been able to produce wines and liquors in three to nine months, which can hardly be distinguished from similar products which have aged from 2 to 10 years. These manufacturers have found that the use of ozone is of much value in sterilizing the implements used in the manufacture of wines and liquors.

Ozone is a valuable bleaching agent and is being used in the manufacture of certain chemical substances, especially mineral, vegetable, and animal fats, oils, and greases. The bleaching effects of ozone are superior to those of chlorine and are more striking as it serves not only to bleach but to destroy disease-producing germs.

Ozone for the sterilization of drinking water is a very important application. This has been the subject of elaborate investigations carried on during the last ten or fif-

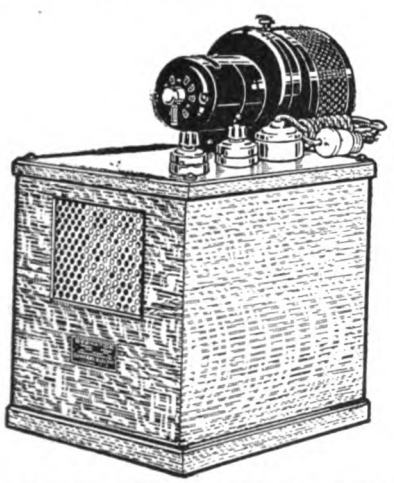
Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

teen years, and no line of application has brought ozone more prominently to the front than that of water sterilization.

To give a more definite idea of the magnitude of the work already undertaken abroad, the following installations may be cited:

	Year.	Gallons per day.
Wiesbaden	1901	1,320,000
Paderborn	1902	660,000
Hermanstadt	1909	880,000
St. Petersburg	1910	2,640,000
St. Petersburg		9,900,000
Florence	1911	1,100,000
Also the installations at:		
St. Maure near Paris		6,600,000
Chartres		1,100,000
Nice		10,000,000

In addition to the above, works of this character are now being erected for the municipalities of Paris, Chemnitz, and Rovigo, while a large number of private installations have been supplied, among those being Cambridge university.



ALTERNATING CURRENT UNIVERSAL OZONATOR.

It should be noted that some of these installations have been in operation nine or ten years, and that in St. Petersburg water purification was undertaken on an enormous scale in 1910. It is hardly possible that these older installations would have been kept in operation had not frequent and thorough investigation indicated that satisfactory sterilization was obtained, nor is it probable that St. Petersburg would, so many years later, invest an enormous amount of capital in a similar scheme had not the government authorities convinced themselves of its great advantages.

As stated elsewhere, ozone can be quickly and conveniently produced by the passage of air between electrified surfaces. Apparatus built on this principle is in common use. The manner in which ozone is produced is interesting. A transformer raises the supply-voltage to a point sufficiently high to operate the ozonizer, that part of the device in which the ozone is actually produced. This consists of a number of glass tubes coated with a layer of fine copper wire, covered by a coating of japan and containing steel enameled vanes separated from the inner walls of the tubes by small ring-shaped air gaps.

One of the high-tension leads of the transformer is connected to the copper coating to the glass tubes, and the other is connected to the vanes. When the current is turned on, a violent electrical discharge occurs between the glass and the steel enameled vanes, and the energy of the electric field is absorbed by the oxygen in the air, producing ozone.

Two general types of machine are now on the market for commercial application. One type is used for the home, small office, or small room, and the other is used for places having from 25,000 to 50,000 cu. ft. of space. The small machine consists of a transformer and the tubes, the whole being encased in a mahogany box. On the top of this box is mounted a metal chimney which surrounds the tube, the same being provided with a ring-shaped outlet at the top, through which the ozone is allowed to escape. It is ideal for household use, and has been designed to meet various conditions found in residences and small offices, and, by means of a 2-point switch, should take care of any possible condition which might arise.

The larger type of machine consists of essentially four parts. These are: the tubes, a step-up transformer, a motor-driven blower, and a dust screen. The motor-driven blower and the dust screen, together with fuses and controlling switches, are placed on the top of the case. The transformer and tube are placed within a Flemish oak box. The quantity of ozone can easily be regulated to suit different conditions by means of a 2-point switch. Operating at full capacity, the ozonator gives a flow of 4000 cu. ft. of ozon-

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ized air per hour at a concentration of 900 milligrams. The ozonator provides an economical and effective aid in solving the general problems of ventilation. It purifies the air without setting up draughts, it can be as easily and conveniently installed as an electric fan, and occupies a small amount of space. The operating cost is nominal, as the consumption ranges from 15 watts in the small machine to 70 watts in the large machine. The first cost of these machines is from $35 to $100.

Safeguarding the Induction Motor

It is a characteristic of squirrel-cage type induction motors to take a heavy starting current ranging from three to seven times the full load current. This, in the case of the large motors, may cause a serious drop of potential in the supply circuit, and to avoid trouble from this source, a starting compensator should be used. This device consists of an autotransformer with taps for obtaining a reduced potential, and suitable mechanism for connecting the motor to these taps momentarily for starting, and then, when the motor has attained full speed, disconnecting it from the taps and throwing it directly on the supply circuit. The contacts are immersed so as to take advantage of the break under oil in preventing burning of contacts and disturbances in the circuit. Starting compensators are not usually required for motors smaller that 7½ horse-power.

The design and construction of the compensator illustrated is such as to insure a high degree of dependability. The windings of the coils are thoroughly insulated so as to give a high factor of safety and to render a breakdown of insulation practically impossible. Taps are brought out so as to provide a number of derived voltages sufficient for all conditions of service. After the coils are wound they are baked until all moisture is driven off. The coils are then placed in a vacuum tank and a molten insulating compound introduced under pressure by the vacuum process. The compound penetrates the windings and, on solidifying, forms an indestructible moisture-proof mass which also dissipates heat more readily than coils provided with air spaces would.

In the three-phase compensators, the three coils are connected in Y, the supply circuit to the free ends of the coils, and the connections for starting the motor to the taps. In two-phase compensators, a coil is connected across each phase of the supply circuit, while the starting connections for each phase are connected to one end of the coil and a tap.

The compensators for motors smaller than 18 hp. have three taps, giving 50, 65, and 80% of the line voltage, with line currents, respectively, 25, 42, and 65% of the current that would be taken by the motor if no compensator were used. For motors larger than 18 hp. the compensators are provided with four taps, giving potentials equal to 40, 58, 70, and 85% of the line voltage, equal to 40, 58, 70, and 85% of the line voltage, and respective currents equal to 16, 34, 50, and 72% of the current that would be taken by the motor if it were started direct from the line. After the motor has come up to speed, the handle must be thrown quickly to the running position, the running contacts at the same time being taken care of automatically by the tension of springs which returns the former to the off position, the lugs on the back of the lateral lever arms preventing the contacts from moving farther away than the off position.

The wooden supports for the contacts are treated to make them absolutely non-conducting for the lower voltages, but for 2200 volts and above, porcelain 'saddles' are used.

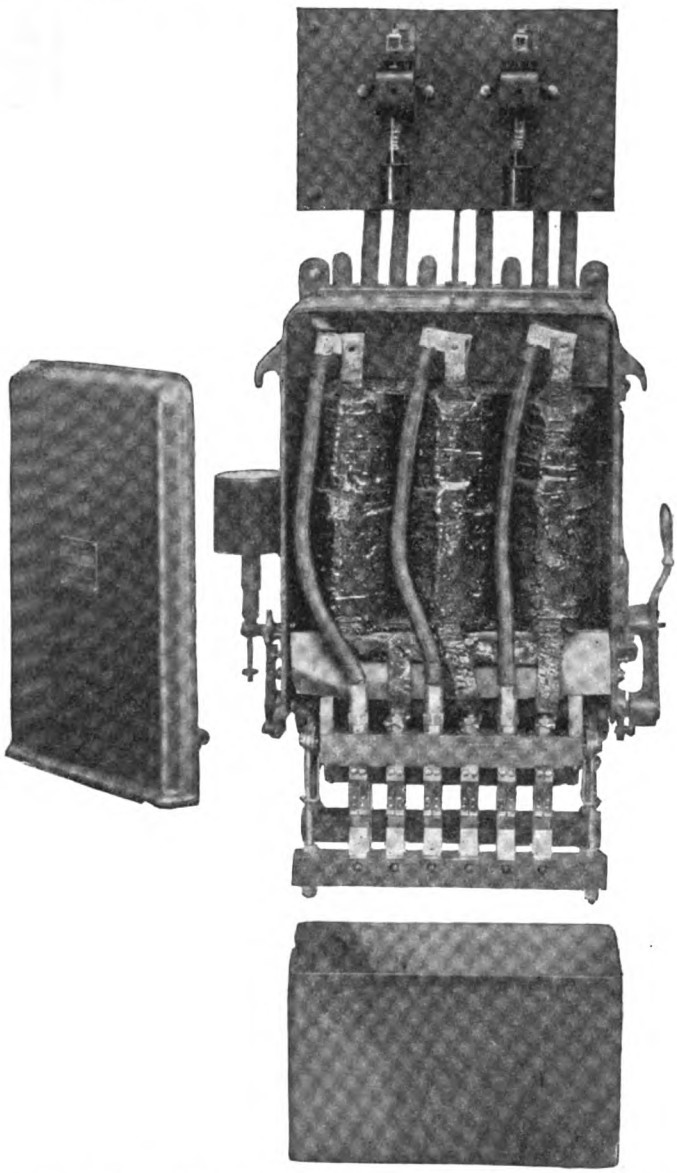
The design of the compensator is such as to render it practically fool proof. A latch, engaging with a lug on the operating handle, prevents the switch being closed in the running position until it has been first thrown to the starting position. This latch will also stop the switch in the off position when throwing from starting to running position unless the throw is made with such rapidity as not to allow the motor speed to fall; for, when the lever is thrown from the starting toward the running position, the lug on it strikes a shoulder on the latch, throwing it upward, thereby allowing the lever to pass to the running position if the throw is quick enough, but stopping it in the off position if the lever does not pass that point before the latch has time to fall and engage with the lug.

The compensator cannot be left in the starting position, for the springs in the mechanism return the contacts to the off

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

position if the handle is released or thrown to the running position.

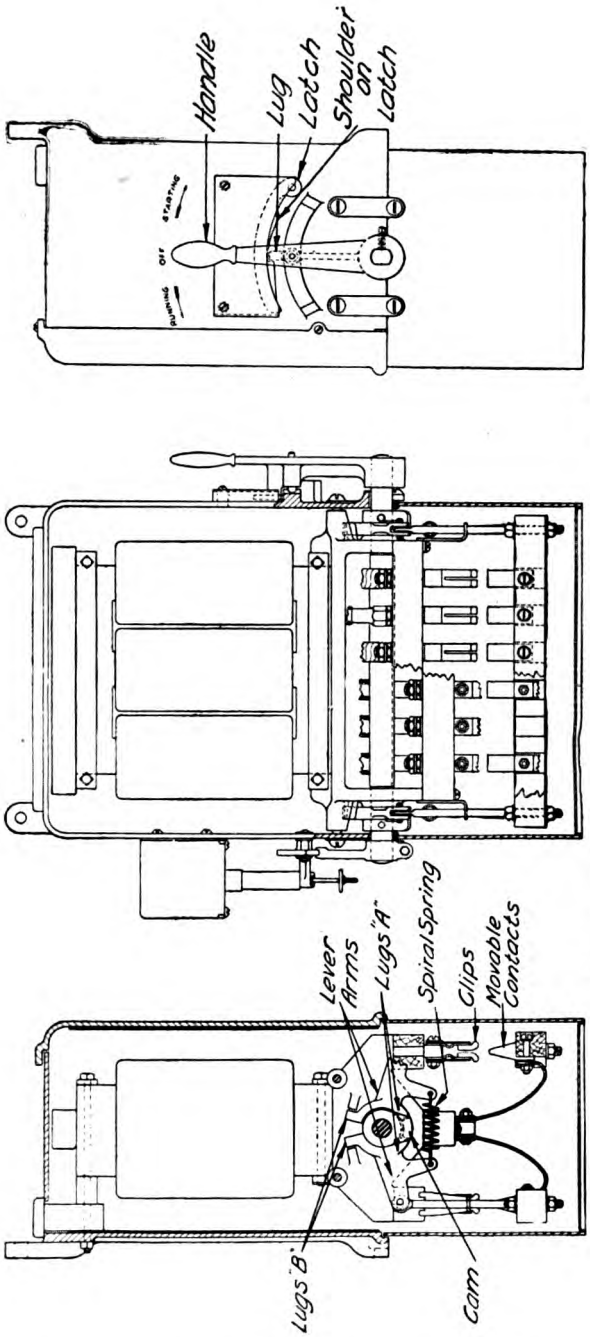
When the switch has been thrown to the running position, an arm at the opposite side of the compensator and on the end of the operating shaft engages with the locking end of a lever so as to hold the switch in the closed position. The tripping end of this lever is connected to the core of the no-voltage release coil, whose circuit is connected to the motor side of the mains from which the machine is operated. This core is of sufficient weight, so that, when the voltage fails and the coil is de-energized, the core drops and strikes the end of the lever with sufficient force to throw up the locking end and release the holding lever, permitting the contacts to be opened by the tension of the springs.



STARTING COMPENSATORS WITH COVER AND OIL-BOX REMOVED.

To guard the motor from injurious over-

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

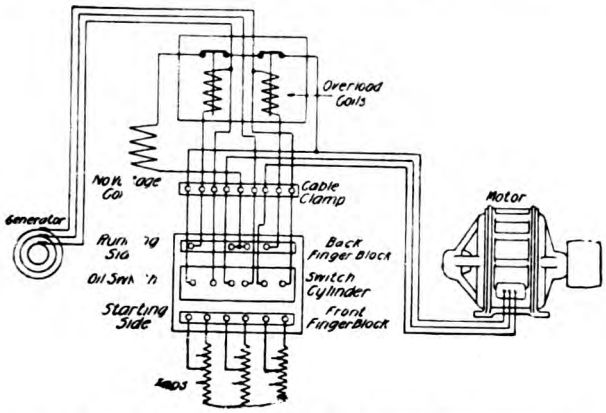


SUSPENSION TYPE OF COMPENSATOR, SHOWING CONSTRUCTION.

loads, all standard compensators listed for 110 to 550-volt induction motors are provided with fuses of the cartridge type mounted on a slate base and separated by barriers. From 1040 to 3000-volt motors, the compensators are provided with series, time-limit, oil-dashpot relay panels, enclosed by a dustproof sheet-iron cover, which shut down the motor if the overload stays on for an interval of time greater than that for which the dashpot is set. These operate through a solenoid whose core, when the

Generated on 2024-09-30 00:20 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

motor is overloaded, is drawn upward against the action of the dashpot, operating a toggle, which in turn opens the circuit of the no-voltage release coil by drawing the vertical strip away from its upper contact, trip the switch. The cup-shaped piston in the dashpot contains two discs with a small hole through them. By adjusting these so as to partly cover up the holes, the size of the passage through the discs may be

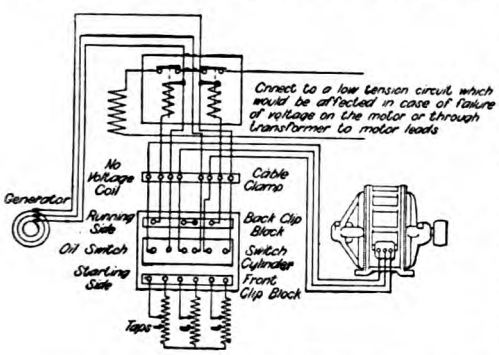


FLOOR TYPE OF COMPENSATOR, SHOWING CONSTRUCTION.

de-energizing the no-voltage release coil, and shutting down the motor as described below.

If desired, the compensators for 110 and 550-volt motors can be provided with the time limit overload relays.

Two overload coils are used, one in each



CONNECTIONS OF THREE-PHASE STARTING COMPENSATOR.

of the two phases, otherwise a short circuit might occur through the two unprotected phases. The overload relay, if properly set, will also guard the motor against running single phase.

The oil dashpot is provided to permit adjusting the overload coils so that a time interval will be required for their operation. Otherwise a momentary fluctuation of load, which would do no harm to the motor, would varied, and, consequently, the time required to force the oil to flow out of the upper part of the dashpot, as the core pulls the discs up, can be varied through a range from instantaneous action to that requiring an interval of 5 minutes. The dashpot can be unscrewed and removed, exposing the discs. As these are locked in position by a milled lock-nut of liberal size, it takes but a moment to make any desired adjustment.

All parts of the compensator are easily accessible when the cover and oil-box are removed.

The line of compensators comprises those for all potentials up to and including 3000 volts, with a line current up to 400 amperes at 550 volts, and 200 amperes at 3000 volts, and they are designed to bring the motors up to approximately full speed within one minute after the switch is thrown into the starting position. These compensators are made in two types, the suspension and the floor type.

Suitable push-buttons may be wired into the circuit of the no-voltage release coil, so as to shut down the motor from a remote point if desired. The push-button would normally be in the closed position.

The overload relay has five calibration points, the lowest being the normal current of the motor and the highest 300% of full-load current. The compensators described

Generated on 2024-09-30 00:25 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

above are manufactured by the General Electric Co., Schenectady, New York.

A New Method for Taking Levels*

The method here proposed is not entirely new, although not known to more than one per cent of the engineers throughout the country, and for the reason that there has never been on the market, or patented, any practical rod for the purpose. The Chicago Steel Tape Co. is about to put on the market, and is applying for patents on a rod, which, it is claimed, will revolutionize the method of taking levels for every purpose. By a peculiar, although simple, arrangement of a leveling rod, the level instrument is made to assume the datum plane, thus making the readings of the rod the exact elevation of the spot on which the rod is held. This eliminates entirely all computation in the field or in the office, which has always been necessary in the common method of taking levels, and makes the columns for '+ Sights', '— Sights' and 'instrument Height', now common in all field level books, of no use whatever. The only columns necessary with this method are for 'Stations' and 'Elevations,' even for 'turning points.'

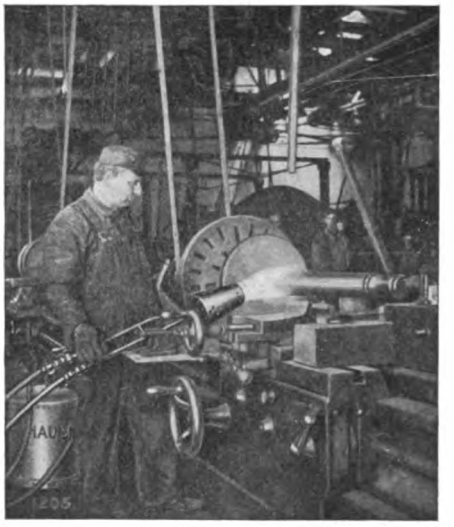
The rod in many respects resembles the ordinary leveling rod. The method of extension can be similar to that of the Philadelphia rod, with one piece sliding on the other, but preferably that of the Chicago rod, which has the entire face on one plane. To any of these rods a short sliding piece is attached to the lower end, and on which the entire rod is raised to the desired height. The face of the rod can be graduated in any of the customary ways, but the figures must increase downward instead of upward, and the unit figures must be interchangeable. Or the rod can have a sliding face, either by the use of a ribbon or other methods. Use can be made of a target the same as is customary at present.

The operation is much more simple than that in customary use at the present time. The saving in time and elimination of error is so great that it is expected soon to become the general practice, notwithstanding that it involves radical change. It has been thoroughly tested for several months by an engineering department in one branch of the government of one of our largest cities and has received unlimited and unanimous commendation from the engineers connected with it.

Hauck Portable Burners

The illustration shows how a bent piston-rod was straightened in ten minutes without removing the piston head or producing scale on rod. This result was obtained with a Hauck portable oil fuel burner, which consists of a seamless drawn steel tank of from 8 to 16 gal. capacity, 12 ft. of special oil-resisting rubber hose, 12 ft. of air hose, and the patented Hauck burner, which is made entirely of iron and steel.

One of the most interesting features of



the Hauck burner is the clean, smokeless flame that can be produced instantly by simply lighting a match to it, without first heating the burner.

It is claimed to be an indispensable tool for welding or straightening locomotive frames, shrinking pinions on geared locomotives and hoisting engines, shrinking bands on cracked cylinders, straightening shafts and frames, rebabbiting engines, setting up bags on boilers, pre-heating for oxy-acetylene welding, brazing, and numerous other heating purposes. This burner is distributed by the Pacific Coast branch of the Hauck Mfg. Co., 24 California street, San Francisco.

*From data furnished by the Chicago Steel Tape Company.

Generated on 2024-09-30 00:24 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Engineering News

Petroleum

Statistics of production for May, according to the *California Oil World*, are as follows:

	Net. May.	Net. April.
San Joaquin valley:		
Coalinga	1,595,882	1,507,539
Kern River	779,048	763,260
Maricopa	450,175	483,757
Midway	2,405,170	2,451,227
McKittrick	368,968	370,379
Lost Hills-Belridge	455,713	391,516
Total	6,054,956	5,967,678
Coast and South:		
Santa Maria, Lompoc, Cat Canyon	427,743	399,442
Salt Lake-Sherman	231,251	216,629
Olinda, Brea Canyon, Puente	526,172	512,868
Whittier	56,704	54,789
Coyote-La Habra	224,896	245,217
Ventura county	71,910	71,470
Newhall	9,355	8,411
Los Angeles City	31,957	31,842
Summerland	4,200	4,350
Total	1,584,188	1,545,018
Grand total for state	7,639,144	7,512,696
Shipments	7,857,406	7,344,980
Losses	96,088	104,884
Total outgo	7,953,494	7,449,864
Surplus	-314,350	62,832

Shipment of petroleum products oversea for May were as follows:

Illuminating—	Gallons.	Values.
Costa Rica	3,500	$ 443
Guatemala	21,000	2,289
Honduras	9,200	1,107
Nicaragua	46,906	5,190
Salvador	18,471	2,211
Mexico	8,206	1,282
Colombia	2,700	361
China	5,800,110	261,010
Japan	3,688,000	165,970
Hawaii	405,093	47,030
Alaska	24,650	3,221
Tutuilla	1,080	145
	10,028,900	$490,169

Lubricating—		
Canada	15,692	$ 2,840
Guatemala	1,277	319
Nicaragua	46	9
Salvador	5	4
Mexico	19,525	6,347
Colombia	10	5
Peru	20	10
China	9,722	1,119
Japan	35,026	5,496
Australia	21,493	4,045
French Oceania	1,156	590
Hawaii	16,758	5,014
Alaska	1,302	466
	121,032	$ 26,264
Naphthas—		
England	30	$ 5
Costa Rica	5,750	985
Honduras	420	89
Nicaragua	355	59
Panama	6,300	1,186
Salvador	415	94
Mexico	30	7
French Oceania	50,023	6,317
Hawaii	281,574	44,184
Alaska	23,450	3,915
	368,347	$ 56,841
Fuel oil—		
Canada	6,048,000	$114,400
Panama	1,848,000	30,800
Australia	2,500	130
French Oceania	10,604	297
Hawaii	2,072,095	35,003
Alaska	2,502,000	47,220
	12,483,199	$227,850
Crude—		
Hawaii	2,457,000	$ 55,950
Salvador	507	12
	2,457,507	$ 55,962
Residuum—		
Chile	2,115,750	$ 31,484
Peru	2,408,194	35,320
	4,523,944	$ 66,804
Asphalt—	Tons.	Values.
Canada	1,047	$ 9,337
Japan	98	1,135
Hawaii	367	3,275
	1,512	$ 13,747

Importations to Peru were 1,866,450 gal. crude, $45,463, and 900,000 gal. benzine, $58,440.

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

California oil dividends for May were:

Amalgamated	$1.00	$ 50,000.00
Amer. Pet. pfd	0.50	8,255.50
do common	0.33⅓	39,607.00
Bear Creek	0.025	17,099.87
Cal. O. F., Ltd	33%	361,595.60
Claremont	0.01	4,500.00
Dome-Pinal	0.01	4,000.00
Home (Coalinga)	0.01	10,000.00
Maricopa Queen	0.005	4,960.48
Mount Diablo	0.0075	7,500.00
New Pennsylvania	0.005	2,488.48
Record	0.05	10,000.00
Rice Ranch	0.01	3,000.00
S. F. & McK.	0.10	5,000.00
Sauer Dough	0.015	2,992.50
Section 25	0.50	20,000.00
State Consolidated	0.01	5,000.00
Union Oil	0.60	184,753.60
Union Prov.	0.60	91,403.02
United Petroleum	0.60	48,450.60
West Coast	1.50	15,000.00
Western Union	0.50	5,000.00
W. K.	0.02	10,000.00
Total		$810,606.65

STORAGE

Field.	Field stocks.	Pipe-line.	End May.	End April.
Coalinga	390,529	2,825,617	3,216,116	3,131,746
Kern River	643,092	28,598,785	29,241,877	29,547,515
Maricopa	236,805	518,077	754,882	836,484
Midway	727,550	1,609,825	2,337,375	2,200,271
McKittrick	109,913	1,015,769	1,125,682	1,073,702
Lost Hills--Belridge	78,709	316,004	394,713	391,487
Santa Maria, Lompoc, Cat Canyon	310,329	447,032	757,361	793,332
Olinda, Brea Canyon, Puente	39,508	112,812	152,320	232,221
Salt Lake-Sherman	81,734	24,929	106,663	120,255
Whittier	30,451	.....	30,451	36,944
Coyote-La Habra	27,160	.....	27,160	36,482
Ventura county	16,976	79,185	96,161	102,160
Newhall	2,111	.....	2,111	2,186
Los Angeles district	15,000	242,757	257,757	313,338
Outside of fields	.....	9,404,847	9,404,847	9,356,666
Totals	2,709,867	45,195,639	47,905,506	48,219,812

OPERATIONS

Field.	New rigs.	Wells drilling: Act.	Wells drilling: Idle.	Completions: No.	Completions: Output.	Producers: Act.	Producers: Idle.	Aban.
Coalinga	3	63	63	6	2165	906	207	1
Kern River	2	8	2	..	....	1656	244	9
Maricopa	..	34	61	2	1450	297	117	..
Midway	13	120	83	17	2405	825	176	15
McKittrick	..	5	20	6	125	244	35	..
Belridge	4	8	31	2	175	75	5	..
Lost Hills	4	12	32	5	955	82	3	..
Santa Maria	..	14	42	3	275	251	39	1
Fullerton	2	21	3	..	....	321	29	..
Salt Lake	..	11	1	..	....	285	23	..
Whittier	1	8	4	..	....	144	12	..
Coyote	2	37	3	2	700	24	...	1
Ventura	1	23	35	8	260	322	27	2
Newhall	..	1	4	..	....	79	4	..
Los Angeles	..	...	...	..	....	412	...	..
Summerland	..	...	...	..	....	125	25	..
Totals	35	365	384	51	8510	6048	946	29

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Power, Gas, and Electricity

San Francisco.—The Oro Electric Corporation has applied to the Railroad Commission for authority to issue $1,000,000 in bonds for the purpose of supplying funds with which to pay indebtedness incurred in construction and to provide money for continuing operations.——Permission has been granted to the San Antonio Irrigating Co. to issue promissory notes in the sum of $30,000 for enlarging its irrigating system.——The San Diego Southeastern Railroad Co. has applied for permission to issue $600,000 in bonds to provide funds for improvements and purchasing equipment.——The Mt. Jackson Water & Power Co. has applied for permission to issue $11,000 in bonds for the purpose of paying certain indebtedness and making improvements in their system. This company operates in Rionido, Sonoma county.——The Central California Gas Co. has applied for permission to issue $10,000 in bonds for the purchase of a gas holder and other apparatus.——The Lassen Electric Co. of Susanville has applied for authority to purchase the Branahan power plant for $4500.——The Pacific Gas & Electric Co. has applied for permission to purchase certain water rights, flumes, etc., from the United Electric Power Co. in the vicinity of Gold Run, Placer county.——Permission has been granted to the Pacific Gas & Electric Co. to sell to the San Jose Water Co. certain property and water rights along Los Gatos creek, Santa Clara county, for $225,000.——Authority has been granted the Pacific Gas & Electric Co. to issue $5,000,000 of its general and refunding mortgage bonds at 85 and $150,000 in promissory notes.——Patents to six mineral claims in the Nooksack river held by Whatcom County Railroad & Light Co., one of the Stone & Webster subsidiaries, have been declared void. The land which includes 300 ft. of water fall reverts to the U. S. Government. The Torrance Electric Light & Power Co. has asked permission to issue 50,000 shares of stock and $125,000 in bonds to provide funds for the purchase of the water system formerly owned by the Dominguez Ranch Co.——The Burbank Electric Light & Power Co. has asked permission to sell its plant to the city of Burbank.——R. E. Cavanaugh has asked permission to sell his electric light plant at Edgewood, Siskiyou county to the California-Oregon Power Co. for $10,000.

San Bernardino.—Work of grading the line of the Pacific Electric Co. between this city and Uplands is well under way.

Los Angeles.—It is expected that a rate of 30c. per 1000 cu. ft. will be established for natural gas within the city.——It is stated that the pressure is insufficient to carry the natural gas supplied by the Midway Gas Co. through the city mains for distribution and that compressors will have to be installed in the oilfield to remedy this difficulty.——The San Joaquin Light & Power Co. has found it necessary to double the capacity of its plant at Taft and McKittrick to supply the growing demands for electric power in the oilfields. Two thousand additional horse-power is being installed for McKittrick, Belridge, and Lost Hills fields, and in addition 14 motors are operated by the Reward Oil Co. for pumping and power for the dehydrating plant.——The street committee of the Board of Supervisors has instructed R. H. Monohan, city electrician, to present an ordinance requiring that all telephone and lighting companies place their lines in underground conduits in the district bounded by 7th and Macy street, Alameda and the river. Altogether about 7 miles of conduit will have to be installed.

Nevada City.—Permission has been granted to the Birchville Mining Co. to appropriate 250 miner's inches of water for power purposes.

Greenville, California.—Work has been resumed on the Great Western Power Co.'s dam at Nevis. Over a million acre feet of water will be impounded in the new reservoir.

Tuolumne, California.—It is stated that the Tuolumne Light & Power Co. will commence work on its power project this summer. An ultimate expenditure of $2,000,000 will be required to complete the work.

Spokane, Washington.—It is stated that the Montana Power Co. will extend its operations into the Coeur d'Alene district in Idaho in competition with the Washington Power Co. John D. Ryan, president of the Amalgamated Copper Co. is head of the Montana Power Company.

Klamath Falls, Oregon.—The city council is taking steps toward the establishment of a municipal light and power plant. Negotiations are under way with the Secretary of the Interior for the acquisition of the power site and water rights.

Generated on 2024-09-30 00:21 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Farmington, Utah.—The property of the Davis County Light & Power Co. operating a hydro-electric plant in this town has been sold to the Utah Light & Power Company.

Park City, Utah.—The city council has received a favorable report upon the application of Lewis A. Jepps for a 25 year franchise for the erection of an electric lighting plant for this city.

Salt Lake City.—The Utah Power & Light Co. has taken over the property of the Bear Lake Power Co. with headquarters at Montpelier, Idaho. The latter company has two plants, one at Georgetown and the other at Paris, with transmission lines between 30 and 40 miles long.——Plans have been completed for the construction of dams at the outlet of Lake Phoebe at the head of Big Cottonwood canyon for impounding lake waters and have been submitted to the state engineer for approval.——The city engineer has been instructed to prepare plans for systematic improvement of the city's water supply; $60,000 is the estimated cost of dams to provide a reservoir having a capacity of 318,000,000 gal.——The city commission is considering the advisability of building two relay-reservoirs on the east bench and a large water main on 13th street to relieve Parley's conduit.——A resolution has been placed before the city council for the construction of a dam across City Creek canyon for impounding 40,000,000 gal. of water for emergency purposes. The estimated cost of the dam and reservoir is $90,000. W. H. Korns is city water commissioner.——A resolution has also been offered embracing a comprehensive plan for the development of a municipal water supply involving an extensive plan of construction work covering a term of years, and it is proposed to call for a bond election to provide $600,000 for furnishing funds to carry on this work. Sylvester Cannon is city engineer.

Railways

San Francisco.—The Railroad Commission has authorized the Los Angeles & San Diego Beach Railroad Co. to issue notes in the sum of $28,000 in payment for Edison storage battery motor cars to be used on the company's system between San Diego and La Jolla.——The Pacific Gas & Electric Co. has been authorized to construct its railroad at grade across 14 public highways in Orange county.——It is stated that the Southern Pacific Co. has completed survey and purchased right of way for a line extending from one of the Berkeley branches through the foothills into the San Ramon valley.——It is stated that work is to commence on the Sacramento Valley Electric railroad within three months. The portion to be built will consist of 35 miles of single track from Solano city to Woodland at a cost of $1,000,000. Permission is to be asked from the Railroad Commission to authorize bonds in the amount of $6,000,000. The directors of the company are C. L. Donohue, E. L. Sissy, H. W. Manor, R. E. L. Stevens, A. C. Huston, J. Reith Jr., and L. P. Klenner. Melville Dozier Jr. of Haviland, Dozier & Tibbets, San Francisco, will have charge of construction of the road.——The board of supervisors has been recommended to provide a redemption period of 35 years for the proposed municipal railroad bond issue of $3,500,000. The election to ratify this issue will take place on the last Tuesday in August.——The directors of the Nevada County Narrow Gauge railroad have ratified a bond issue of $500,000 to provide funds for the broad gauging of the company's road from Colfax to Nevada City.——The Western Pacific railroad has asked permission of the Railroad Commission to issue $81,250 in promissory notes to be used in part payment for 100 oil-tank cars.——The Oakland, Antioch & Eastern Railroad Co. has requested permission of the Railroad Commission to issue 4,000,000 of its $5,000,000 authorized bond issue.——The San Pedro, Los Angeles & Salt Lake Railway has been authorized by the Railroad Commission to issue $1,119,000 in first mortgage bonds to provide funds for general betterments and improvements; $500,000 is to be expended for locomotives and other rolling stock; $139,000 for terminals and shop improvements; $161,000 for new bridges, trestles, and grade reductions.

Los Angeles.—The Santa Fe Railroad Co. is planning to spend $2,000,000 for the construction of a new branch railroad around the foothills from Minkler to Porterville approximately 100 miles in length.——The Pacific Electric Co. is endeavoring to secure a franchise from the Board of Supervisors for the establishment of the first unit of an elevated railroad system from the rear of the Pacific electric building along San Pedro street north to relieve congestion on Main street.

San Diego.—It is stated that the Southern

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Pacific Co. will expend $3,500,000 for the construction of the San Diego & Arizona Railroad.

Solano.—Rights of way have been granted by the Solano Irrigated Farms Co. to the Sacramento Valley Electric Railroad.

Marysville.—The formal opening of the Marysville-Colusa branch of the Northern Electric Co. took place on June 14. E. R. Lilienthal is president and B. P. Lilienthal is vice-president, W. P. Hammon director, and A. B. Schindler is general manager.

Yreka.—The Humboldt-Siskiyou & Klamath Railroad Co. is to be incorporated for the purpose of building a railroad between Eureka and Klamath Falls along the shore of the Klamath river a distance of 350 miles. A committee of 9 has been appointed to make preliminary arrangements to provide $35,000 for the expense of covering the preliminary work. L. F. Butler of Eureka presided.

Meridian.—The Northern Electric Railroad is securing right of way for the new branch line to run from Woodland to Colusa.

Salt Lake City.—At a meeting of the stockholders of the Salt Lake & Utah Railroad Co. the following officers were elected. W. C. Orem is president, H. C. Joy and James G. Berryhill, vice-presidents; F. M. Orem, secretary and treasurer; P. H. Cook, general traffic manager; W. R. Armstrong, assistant general manager; G. F. Arentz, chief engineer; and Henry R. Moore, general attorney. Contracts for construction work are being let.

Bingham, Utah.—An amendment to the articles of incorporation of the Bingham & Garfield Railroad Co. has been filed increasing the capital stock from $2,500,000 to $6,000,000. The road is to be electrified and other improvements are to be made.

Pocatello, Idaho.—Surveyors are in the field working on the proposed new street car system. The franchise was granted in February. L. R. Martineau of Salt Lake City is engineering the project.

Phoenix, Arizona.—The State Corporation Commission has granted permission to the El Paso & Southwestern Railroad Co. to consolidate six companies comprising the system which controls 458 miles of road in Arizona, and 440 miles in New Mexico.

Streets and Roads

Oakland.—The Board of Supervisors has authorized the completion of improvements on the county boulevard between Hayward and Livermore. $78,000 has been appropriated for this purpose. P. A. Haviland is county surveyor.

Berkeley.—An extensive plan for street improvements has been adopted by the city council to be carried on during the summer months.

Bakersfield.—The County Highway Commission has submitted an estimate to the Board of Supervisors for a series of graded and paved roads to be built at a cost of $2,500,000. A total of 313½ miles is included in the project. The estimated cost averages about $7500 a mile.

Suisun.—Extensive bridge and road work is projected for Solano county after July 1.

Napa.—The supervisors have approved the petition of a number of property owners for the construction of a permanent road system; 8½ miles of macadam roadway 16 ft. in width is to be built at a cost of $20,000.

Colusa.—A committee of the Board of Supervisors has reported that a sum in excess of $573,000 will be required to effect the necessary improvements on county roads. A bond issue will be called for within the next few months to provide funds for carrying out this work.

Spokane, Wash.—The construction of a new intercepting sewer system in the downtown district is under consideration. About $250,000 will be required for doing this work. Z. E. Hayden is commissioner of public works.——Eight miles of model highway is to be built. This will include a paved road 16 ft. wide with 4 ft. shoulders on either side. Bids will be received on all types of road including one-course concrete, two-course concrete, dolarway, bitucrete macadam, warrenite, bitumass asphalt, and asphalt macadam. J. W. Stark is county engineer. The approximate cost of the road will be $10,000 per mile.——Plans are ready for the Trent road viaduct to be constructed jointly by the county, the Spokane International Railway, and the Spokane Inland Empire Railway.——The county commissioners will call for bids for what is known as the Morgan south permanent highway No. 8.——The city council has awarded contract for paving Mission avenue from Division street to river bridge to Mitchell Bros. for $39,764. Spokane bituminous pavement will be used.——The State Highway Commission has approved plans for a mile of road at the Lincoln county line on the Sun-

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

set boulevard. Bids will be advertised for gravel macadam road to be returnable July 20. The cost will be approximately $6000.

Salt Lake City.—P. J. Moran has offered to lay Utah rock asphalt on paving extensions 88 to 89 for $1.65 per square yard.

Odgen, Utah.—Paving contracts aggregating $36,138.01 were awarded on June 17 to P. J. Moran Company.

Wilbur, Wash.—County surveyor Thayer is making surveys for the grading of a number of streets.

Colfax, Wash.—The city council has authorized macadamizing a number of streets.

Coulee City, Wash.—Plans have been adopted for the improvement of 2¾ miles of road. $13,000 is available for this purpose and bids will be advertised at once. Mr. Stradling is county engineer.

Walla Walla, Wash.—A petition has been presented to the county commissioners for the construction of 12 miles of road.

Wallace, Idaho.—The city council has decided to install a paved street at a cost not to exceed $1.70 per yard.

Pocatello, Idaho.—Contract has been awarded to the Strang McGuire Paving Co. for paving South Arthur street and 7th avenue at a price of $6.07 per lin. foot.

Boise, Idaho.—Ada county has voted to issue $200,000 bonds for the purpose of building good roads.

Irrigation and Water Supply

San Francisco.—The Railroad Commission has authorized the San Jose Water Co. to issue $100,000 in notes to provide funds for paying existing indebtedness, for purchasing water rights in Los Gatos creek and for new construction.——The Davis Water Co. of Davis, Yolo county, Cal., has asked permission of the Railroad Commission to purchase the water plant of Schmeiser Mfg. Co. for $6300, and to make additions and improvements to the extent of $28,000.——The Solano Irrigated Farms Co. has about 60,000 acres of land which is being placed under irrigation for immediate sub-division and sale. A complete sterilization and filtration plant is to be installed for furnishing water to farms and towns of Solano county. Mr. Hyde of the University of California will superintend construction. The plant is to have a capacity of 200,000 gal. per minute.——The Power & Irrigation Co. of Clear lake has brought suit in the U. S. District Court to condemn land in townships 12 and 13 N. range 7 W. for the purpose of constructing a dam near the outlet of Clear Lake to convert the lake into a reservoir.

Woodland.—The Fair ranch will install five 50-in. centrifugal pumps to be operated by 300 hp. in electric motors for furnishing water for supplying a sub-irrigation system.

Chico.—Plans are in course of preparation for establishment of an irrigation district including 10,000 acres of land in the Paradise section. L. J. Phelps of Paradise is chairman of the committee. Martin C. Polk is city engineer.

Oroville.—An irrigation district is in course of organization comprising land along the Feather river about seven miles wide and fourteen miles long including approximately 60,000 acres. A committee has been appointed to devise ways and means for promoting this enterprise. E. B. Ward is secretary of the Chamber of Commerce and S. J. Norris is engineer.

Yuba City.—The Sutter Basin Irrigation Co. has filed a mortgage in the sum of $6,000,000. This is preparatory to bonding the Sutter Basin district for raising funds for the reclamation and drainage for 60,000 acres of land.

Red Bluff.—The Midland Canal Irrigation Co. has filed articles of incorporation. The authorized capital stock is $1,000,000. The officers of the company are: W. F. Boardman, S. C. Ashill, Robert M. Harding, William Nunlist, J. J. Webb, W. A. Simmons, and W. C. Crittenden.

Quincy.—The Quincy Water Works is covering several hundred feet of open ditch in the mountains and is also enlarging its reservoir.

Santa Cruz.—The voters have authorized the issue of $220,000 in bonds to redeem the municipal water plant recently sold under foreclosure proceedings. Provision has been made for an additional water supply of 1,600,000 gal. daily.

Los Angeles.—The civic commission has authorized an appropriation of $1960 for laying two 6-in. water mains on Capitol hill. C. F. Barrett is superintendent of the city water department. The finance committee of the city council recommended that the pipe line between Proctor and Mojave together with 102 acres of land be advertised for sale. This line is 13½ miles long.——The petition of the Imperial Valley Water

Generated on 2024-09-30 00:20 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Co. No. 3, to purchase water from the California Development Co. for the irrigation of 60,000 acres of land has been granted.

Sacramento.—The city commission has adopted specifications for a pumping engine to have a capacity of from 10,000,000 to 14,000,000 gal. of water daily and to cost from $6000 to $12,000, depending upon the type of prime mover selected.——It is stated that the U. S. army engineers have received authority from Washington to proceed with widening and straightening the mouth of the Sacramento river from Rio Vista to Collinsville. $800,000 has been appropriated for this work which marks the commencement of the whole project of irrigation and flood control in the Sacramento valley which will ultimately cost in excess of $33,000,000. ——Albert Givan, city engineer, gives the following estimate of cost of all proposed levee work.

Earthwork for levee construction on Sacramento river levees and B-street levees	$ 268,720
Retaining walls along water front	220,000
Revetment work	141,185
Right of way	9,900
Raising and repaving Front street	19,250
Retaining walls on east side of Front street, and on O, P, and Q streets	23,200
Total cost of levee improvement	$ 683,255
Bryte Bend Weir and By-Pass—	
Right of way	$ 409,000
Earthwork for levee construction	223,983
Excavation for levee removal	59,709
Shoo-fly line for railroad	6,000
Excavation for weir piers	1,000
Revetment work	138,230
Weir	325,823
Total cost of weir and by-pass	$1,163,745
Levee improvement	$ 683,255
Weir and by-pass	1,163,745
Total levee improvement	$1,847,000
Previously voted	887,000
Amount necessary to complete plan	$ 960,000

Riverside.—The New York Life Insurance Co. has purchased $100,000 of the remaining $560,000 of the $1,160,000 issue for the municipal water system.

Klamath Falls, Ore.—Further consideration of the feasibility of reclaiming 600,000 acres of more swamp land around lower Klamath lake is under way. E. C. Hopson of the U. S. Reclamation Service has been called into consultation on the work.

Endicott, Wash.—A bond issue has been passed by the voters to provide $12,000 for building a municipal water works. C. H. Green & Co. are the engineers who will handle the construction.

North Yakima, Wash.—The city commission is considering the construction of a wood or concrete pipe-line 50 in. diameter and 8 city-blocks long.

Ogden, Utah.—The Hooper Canal Co. has commenced preliminary work on a dam and reservoir in Dry canyon which will cost about $50,000. A. F. Parker is the engineer in charge.

Salt Lake City.—It is stated that the borings for artesian water in Immigration canyon have proved successful, the second 10-in. well driven in the lower sump having produced an average flow of 130 gal. per minute. C. F. Barrett is superintendent of the water works and S. Q. Cannon is city engineer.——Plans are under way for making preliminary an investigation to obtain data upon which to base a bond issue to provide funds for a complete new city water system. It is expected that approximately $600,000 will be expended for this purpose.

Lehigh, Utah.—The Provo River Reservoir Co. has completed a siphon 764 ft. long, made of portland cement for carrying water across Dry creek.——The Utah Lake Irrigation Co. has completed its canal way to Lehigh and is just about to complete a tunnel 6 ft. in diameter and one mile in length for supplying water for irrigating 10,000 acres in Utah and Salt Lake counties.

Castle Dale, Utah.—The people have authorized a bond of $14,000 to provide funds for the construction of a new water works sytem.

Washington, D. C.—President Wilson has ordered the restoration to entry of 600 acres of land along the Pit river in Modoc county, Cal., which was withdrawn for power sites. Of this, 80 acres lie south of Alturas and 520 acres lie northeast of Alturas.

Denver, Colo.—It is stated that work will be commenced upon the east canal of the U. S. Government's Uncompahgre project as soon as necessary legal steps can be taken to obtain right of way.

Generated on 2024-09-30 00:18 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Miscellaneous Engineering Construction

San Francisco.—The estimated cost of the proposed Twin Peaks tunnel is $4,500,000. Tentative plans have been made. M. M. O'Shaughnessy is city engineer.——The Board of Supervisors has been requested to appropriate $225,000 for the construction of the north end of the 48th avenue sewer. They have also been requested to appropriate $40-419 for paving with basalt a section of Bay street.——Contract has beeen let to the Daniel Contracting Co. of San Francisco for the construction of a rock fill for the new Key Route pier. The fill will be 200 ft. in width to accommodate four tracks. Contract will require about 10 months for completion and will involve an expenditure of approximately $500,000.——The State Department of Engineering is preparing to commence work of clearing the channel of the Feather river between the mouth of the stream and Marysville; restraining walls and jetties will be built.——A contract has been awarded to the U. S. Steel Products Co. for supplying steel for the new City Hall at a price of $476,283. This price was $73,417 lower than the lowest local bid. Plans and specifications for the excavations and concrete foundations for the new City Hall have been approved. It is estimated that this work will cost $48,000. Bids will be received on July 9.——The Associated Oil Co. has let a contract to the Union Iron Works of San Francisco for the construction of a new oil tanker having a capacity of 62,000 barrels.

Richmond, Cal.—Ground has been broken for the municipal channel which is to cost when completed $400,000.——The Ellis Dock & Landing Co. has broken ground for the construction of its first dock and warehouse.

Berkeley.—The city council has taken steps toward the sale of $570,000 worth of bonds for various municipal improvements. Of this amount $475,000 is to be expended for the construction of new sewers. Plans and specifications for these are not yet ready.

San Rafael.—A bond election is to be held for the purpose of authorizing an issue amounting to $215,000 for various municipal improvements including street work $100,000, municipal park and bath house $25,000, street repair plant $25,000, garbage incinerator $25,000, and dredging $40,000.

Vallejo.—The city is contemplating the expenditure of $75,000 for the construction of a retaining wall on the water front.——Specifications have been received at the Mare Island navy yard for dredging 2,600,000 cu. yd. of mud and rock in the Mare Island channel. Bids will be opened at Washington, D. C. on July 26.

Los Angeles.—The board of public works is considering the purchase of 4 locomotives, 40 dump cars, and 10 flat cars. S. A. Judd is assistant harbor engineer.——The water board has placed an order for 5611 tons of cast iron pipe costing in all $176,858.72. The U. S. Cast Iron Pipe Co. was the successful bidder.——The city council has recommended the immediate construction of the First and Second street channels. Specifications and plans have been ordered to be prepared.——Bids have been asked for the excavation of a part of Knob hill at San Pedro for the harbor boulevard right of way and the razing of Timmins point at a total cost of $120,000.——The Franklin Canyon channel for the Owens river aqueduct distribution system is completed.

Chico.—The Chico Construction Co. has taken over the Northern California interests and contracts of the Ransome Crummey Construction Company.

Sacramento.—Haviland, Dozier & Tibbets have submitted a bid for the construction of the north and south levees of the bypass to be erected by the city. The bid is on a sliding scale. It is stated that the cost of excavation per cubic yard is between 10 and 14 cents.

Redding.—The city trustees have accepted plans for the reinforced concrete bridge to be built at the north end of Market street across the Sacramento river. The bridge will be 21 ft. wide and 800 ft. long, and cost approximately $45,000.——A special election will be held on July 2 for the purpose of authorizing a bond issue of $60,000 to build the bridge.

Stockton.—An election is to be held in September for the purpose of voting a bond issue of $1,275,000 for the purpose of installing a new sewer system costing $600,000, and high pressure water system to cost $325,000, a new city hall to cost $350,000.——The U. S. Government through the U. S. Army Engineer Corps will receive bids in San Francisco until August 9 for dredging Stockton channel, Fremont channel, and McLeod lake.

Generated on 2024-09-30 00:19 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Colusa.—A meeting of business men has recommended to the Board of Supervisors that bonds be issued for the purpose of building new roads, bridges, and culverts throughout the county.

Willows.—The Ross Construction Co. has been awarded a contract for the construction of the Orland bridge at a cost of about $115,000. Reinforced concrete will be used throughout. Much other bridge and culvert work is to be done.

Spokane, Wash.—The Kelly Atkinson Co. has commenced work on the bridge for the Oregon-Washington R. R. & N. Co. across the Spokane river.

Seattle, Wash.—The voters of Seattle have cancelled the $5,000,000 bonds for the building of a terminal at Harbor island and have authorized $3,000,000 in bonds for the development of terminals on the east waterway.

Kellogg, Idaho.—An issue of bonds amounting to $30,000 has been authorized by the voters for the purpose of building new sewers. Robert Sterling is city engineer.

Salt Lake City.—The repair shops of the Denver & Rio Grande Railroad were destroyed by fire on June 19 last. The loss is stated to be approximately $150,000. The shops will be rebuilt at once.

Santa Monica.—The city engineer has been instructed to prepare plans for an assessment district to provide between $80,000 and $90,000 for the installation of a fire-protection system.

Opportunity, Washington.—The Inland Empire Paper Co. has let contracts for $35,000 reinforced-concrete building and approximately $200,000 worth of new machinery is to be installed for manufacture of paper.

Livingston, Montana.—The $225,000 bond issue for new water-works plant was carried by a vote of 382 for and 74 against. Plans and specifications have been prepared and bids will be received some time in June.

Herington, Kansas.—Bond election has been called for $50,000 for water-works improvements consisting of pipe-line and new supply from Kohl and Will springs, west of Abilene. Plans have been approved.

Los Angeles.—An estimate has been prepared by Franklin D. Howell, consulting engineer, covering the cost of the municipal harbor terminal railroad as follows:

The cost of construction of a harbor belt line railway to reach all the water front of both Los Angeles and Long Beach, including classification yard, is as follows:

Double track main lines	$2,266,060
Classification yard	1,075,166
Total cost	$3,341,226

Of this expenditures will probably be required as follows:

Fourth street, San Pedro, S. P. & P. E. railway connections, to Miner fill and municipal dock No. 1	$136,309
Wilmington slips to connection with the S. P. Co.	113,703

This is probably all that could be usefully expended in construction during the years 1913-14, except for tracks upon docks and wharves and for yard room in connection therewith.

All lands required for yard and rights of way should also be purchased as soon as possible, as these are liable to increase in price later.

Total rights of way required for main lines	$731,200
Total lands required for classification yard	441,750
Total expenditure during the years 1913-14	$1,422,962

With the municipal dock No. 1, Minerfill, and Wilmington slips in operation it would then be expedient to start construction toward the classification yard, and of the classification yard in sections to accommodate the business, say at the rate of about $250,000 per annum.

In addition to the construction of the main lines of the harbor belt line railway will be required tracks on the wharves and docks, these to be constructed as the business calls for them.

Panama-Pacific Exposition

Contract has been awarded for the construction of the Palace of Mines to Strehlow, Freese & Peterson for the sum of $217,997. The cost of lumber is not included. This is the ninth exhibit structure for which contract has been let, the construction of the machinery, education, food products, agriculture, liberal arts, manufacturers, varied industries, and mines buildings being well under way. Contracts are yet to be let for four additional structures.

Generated on 2024-09-30 00:17 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Personal

B. K. STROUD is in San Francisco.

S. SHANNON has been made a director of the Oro Electric Corporation.

E. A. BOWDEN has been appointed general manager of the Nevada county narrow-gauge railroad.

LOREN E. HUNT is acting city engineer during the absence of M. M. O'Shaughnessy at Washington, D. C.

T. WARREN ALLEN, of the road section of the U. S. Department of Agriculture, has been at Ogden, Utah, inspecting roads.

LEON H. NISHKIAN, of San Francisco, has been appointed structural steel engineer for the city bureau of building inspection.

A. M. FINLAYSON, geological engineer for the Indo-Burma Petroleum Co., Ltd., of London, has been visiting the California oilfields.

J. J. DICKINSON, of New York, has been appointed representative of the U. S. State Department at the Panama-Pacific Exposition.

NATHAN C. GROVER, of New Jersey, has been appointed chief hydraulic engineer of the water resources branch of the U. S. Geological Survey.

HAROLD J. DOOLITTLE has been appointed assistant chief engineer for the Washington state highway commission, with headquarters at Spokane, Washington.

M. M. O'SHAUGHNESSY, city engineer of San Francisco, is at Washington, D. C., in connection with the Hetch-Hetchy water-supply project for San Francisco.

J. W. ROBERTS, state highway commissioner of Washington, has been inspecting the proposed route of the Inland Empire highway.

P. A. HAVILAND, of San Francisco, has been in Washington, D. C., on business connected with the Richmond harbor improvement project.

JOHN DUDER, assistant city engineer of Salt Lake City, has resigned his position to become chief engineer for the A. A. Clark Contracting Company.

ROBERT A. THOMPSON is chief valuation engineer of the western division for the physical valuations of the railroads of the United States, with headquarters at San Francisco.

B. H. BURRELL, chief highway engineer of the United States office of public roads, has been at Salt Lake City to serve in an advisory capacity on the Salt Lake county good roads project.

R. D. ROBERTSON, of the Irrigation Investigation Bureau of the U. S. Department of Agriculture, has been investigating the duty of water used for irrigation purposes at Gridley, California.

H. T. COREY and BURTON SMITH represented the Modesto and Turlock irrigation districts at the hearings recently held in Washington, D. C., with regard to the Hetch-Hetchy water-supply project.

Commercial Paragraphs

CHAS. C. MOORE & CO.'S Seattle office has received the contract for the installation of an 825-hp. single-unit Sterling water-tube boiler for the Willapa Lumber Co. at Raymond.

The KOEHRING MACHINE CO., of Milwaukee, has issued a 30-page pamphlet on street paving concrete mixers. Copies may be obtained from Harron, Rickard & McCone, the San Francisco representatives.

The NEW LONDON SHIP & ENGINE CO., of Groton, Connecticut, reports the closing of a contract with the U. S. Navy Department for furnishing complete working plans for two Nürnberg-type oil-engines aggregating 5000 hp. These engines will be used for one of the new oil fuel carriers recently authorized by Congress.

The AMERICAN ROAD CONGRESS will hold its third annual meeting at Detroit during the week of September 29. This congress includes practically all of the good roads organizations throughout the United States, and is held under the auspices of the American Highway Association, the American Automobile Association, and the International Association of Road Machinery and Material Manufacturers. The officers of the congress are: Logan Waller Page, Director of the United States Office of Public Roads, president; Lee McClung, former Treasurer of the United States, treasurer; J. E. Pennybacker, secretary of the American Highway Association, secretary; and Charles P. Light, former State Highway Commissioner of West Virginia, assistant to the president. The headquarters of the congress are in the Colorado building, Washington, D. C.

Generated on 2024-09-30 00:25 GMT / https://hdl.handle.net/2027/uiug.30112007837898
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN